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ABSTRACT

This monograph examines the issues surrounding the educational movement toward emphasizing critical thinking in our schools. The emergence of the critical thinking movement in education in today's schools is discussed in the light of the historical role of schools in our society and the developing complexity of educational needs. The concept of critical thinking is defined and research findings on the importance of early development of critical thinking skills in children are reviewed. The responsibility of the schools in developing sound approaches to teaching children to think for themselves in creative ways is underscored by a discussion on instructional and curriculum improvement. A section of the monograph is devoted to means for evaluating critical thinking skills. Recommendations are made for changes in educational policy and practice and the increasingly crucial role of the professional teacher is discussed. Sample questions requiring critical thinking in various disciplines are appended as well as a glossary of critical thinking terms and references for further reading. (JD)

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The Great Critical Thinking Debate

From Educational Ideal to Educational Reality

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The Goal of Critical Thinking: from Educational Ideal to Educational Reality

Debbie Walsh, Ph.D.
and
Richard W. Paul, Ph.D.

American Federation of Teachers
Educational Issues Department

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ABOUT THE AUTHORS

Debbie Walsh is Assistant Director of the American Federation of Teachers Educational Issues Department and a former elementary school teacher in Chicago, IL.

Richard W. Paul is Professor of Philosophy and Director of the Center for Critical Thinking and Moral Critique, Sonoma State University, Rohnert Park, CA.

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CHAPTER 1: CRITICAL THINKING: THE STATE OF THE ART

A. Introduction

We live in a rapidly changing and unpredictable society in a rapidly changing and unpredictable world. To survive economically we need the kind of generalized thinking skills that cannot become obsolete with the ever-changing demand for new specialties and the obsolescence of old ones. To survive politically and personally we need the kind of generalized thinking skills that enable us to penetrate the complex nature of the information, misinformation and disinformation around us. We need to be able to think perceptively and critically about issues both within our own personal lives and—more problematically—in the larger world beyond. Never before has flexibility of thought been so essential in view of the complexity and the magnitude of the social issues of the day. Never before have critical thinking skills been more necessary for survival.

An implicit purpose of the schools is to prepare students to meet the challenges of their world. We hope to prepare students to meet these challenges, to live productive and satisfying lives and to participate in a democratic society. Such is the ideal of education in a democratic society.

A genuine commitment to schooling based on the value of critical-analytic thought at the heart of everyday life and decision requires a profound transformation of emphasis in the schools of today and tomorrow. This commitment requires a transformation from what Hilda Taba has called a stress on isolated bits of information which burden the student's memory with an "unorganized, perishable and obsolescent assemblage of facts," to an emphasis on what Matthew Lipman calls "communities of inquiry": classrooms committed to the process of intellectual inquiry and rational thought.

What is meant by critical thinking? As a working definition, Robert Ennis defines it as "reasonable and reflective thinking that is focused on deciding what to believe and do. Robert Glaser says that it involves three principle elements: 1) an *attitude* of being disposed to consider in a thoughtful, perceptive manner the problems and subjects that come within one's range of experiences, 2) *knowledge* of the methods of logical inquiry and reasoning, and 3) *skill* in applying those methods. Barry Byer describes it as assessing the authenticity, accuracy and worth of knowledge claims, beliefs or arguments. This means teaching children to "think for themselves": to develop critical habits of thought. It requires an integration of knowledge into a perspective of what we *do* with knowledge. It requires emphasizing the intellectual tools and skills that process and organize knowledge. It means helping children develop into adults who are critical thinkers: who seek reasons, who can weigh, reconcile and assess arguments and points of view, who can analyze conclusions.

Philosopher Harvey Siegal calls it the "critical spirit": certain attitudes, dispositions, habits and character traits which can be fostered and developed. The critical spirit or attitude entails a real commitment to the objective evaluation of evidence, a willingness to conform judgement to mindful principles and a pronounced disposition to seek reasons for what is done. There is hard evidence to indicate that emphasizing thinking not only encourages children to be rigorously critical and imaginatively speculative, but also correlates with success in basic academic skills. There is evidence, however, that although most school systems espouse the goals of reasoning, inquiry and critical thinking, few systems accomplish these goals.

This is not to say that everything is open to question—that all positions are morally equivalent and that there are no beliefs and values that can be justified, agreed upon and cherished, which was the emphasis of the failed values clarification movement of the 1970s. The ideal of democracy, for example, is a shared value that can be justified as being the highest form of human governance. The AFT believes that the schools have a responsibility for developing democratic values in our children—that devotion to human dignity and freedom, to justice and truth, to equal rights, to the rule of law, to tolerance and mutual assistance, to personal responsibility, to self restraint and self respect—all must be taught and practiced. These are not values that can be taken for granted or offered as merely one set of options against which any other must be regarded as equally valid. The issue here is that one's beliefs and values must be based on reflective inquiry, thoughtful analysis and reasoned judgement.

B. Historical Role of the Schools

The deepest roots of the critical thinking movement are traceable to the teaching practice and vision of Socrates. By a probing method of questioning, Socrates discovered that many of the authorities of his day could not justify on rational grounds their confident claims to knowledge. Confused meaning, inadequate evidence, or self-contradictory beliefs were often lurking underneath smooth but largely empty rhetoric.

Initially, the schools in this country were established to transmit beliefs conducive to right conduct and successful "industry." As late as 1840, American schools taught students the three R's and some basic catechism, along with a smattering of patriotic history. The school term was short and attendance irregular. In 1800, for example, the average American attended school only 82 days out of his entire life. By 1840 that figure had increased to 208 days, by 1860 to one year, and by 1900 to two years.

The schools never appear, either in purposes or practices, to have been much concerned with critical thought.

Horace Mann describes the nature of the learning of his day:

> I have devoted especial pains to learn, with some de-

> gree of numerical accuracy, how far the reading, in our schools, is an exercise of the mind in thinking and feeling and how far it is a barren action of the organs of speech upon the atmosphere . . . more than 11/12ths of all the children in the reading classes do not understand the meanings of the words they read; and that the ideas and feelings intended by the author to be conveyed to, and excited in, the reader's mind still rest in the author's intention, never having yet reached the place of their destination. (Second report to the Massachusetts Board of Education, 1838.)

The history of the teaching profession fits easily into this picture, as expectations about teachers were driven by the purposes and practices of schooling. In the early days the teacher was any adult who had no other job and could read, write, and cipher. From the very beginning teaching was characterized as low in prestige, low in pay, and lacking in personal freedom.

Teachers were not expected to demonstrate the ability to think critically and analytically about the issues of the day. What was sought was not an independent thinker with "scholarly scruples" but a disciplinarian who could make sure the correct answers were learned. Far from the teacher being allowed to function as an independent thinker or professional, the teacher was cast into the role of transmitter of information and a follower of orders of community authorities. In 1903, for example, Margaret Haley wrote that:

> The teacher [is] an automaton, a mere factory hand, whose duty it is to carry out mechanically and unquestioningly the ideas and orders of those clothed with the authority of position. . . . The individuality of the teacher and her power of initiative are thus destroyed, and the result is courses of study, regulations, and equipment which the teachers have had no voice in selecting, which often have no relation to the children's needs, and which prove a hindrance instead of a help in teaching.

Today these factors continue to contribute to the difficulty of finding the talent to educate children in a society that does not make teaching attractive.

Other more recent events have molded and shaped the aims of U.S. education. The development of the high school evolved from the teaching of a select group, to compulsory schooling for all, creating a large captive audience and a custodial function for the schools. This period marked the beginning of an ongoing debate, says Resnick (1985) over what the appropriate curriculum for secondary schools that serve everyone should be. This forced the schools to try and interest the young by varying the curricula.

In the early 20th century two opposing factions competed: those who favored "mastery of subject matter" versus those who favored meeting "the needs of children." The increased regard for "child development" increased the demands that "mastery" be dropped so that students were free to choose their own subjects. New educational objectives of the time did not even mention the development of the intellect or mastery of subject matter. These "life adjustment" and "progressive" education movements, however, have largely passed as forces in American education. This has been due to the changes in our social system, a more educated public with its own ideas of education, and the demands for increased rigor after Sputnik.

We are now beginning to realize, however, that the "factory model" upon which the schools are based, is inadequate to meet the requirements of survival in a constantly changing and increasingly complex world. Only one-half of the engineering knowledge learned in colleges today for example will be valid in five to ten years because of the rapid changes and discoveries occurring in our technological world. The implications of such societal change for education are enormous.

C. The Present Situation

The lack of attention to critical thinking has continued to the present day, yet the issue emerges in many of the recent education reform reports. For example, Ernest Boyer (former Commissioner of the Department of Education and President of the Carnegie Foundation for the Advancement of Teaching), in his study HIGH SCHOOL (1984) argues that our high schools lack a clear and vital mission, and, as a result, our students lack the capacity to think critically and communicate effectively. In countless hours of study, in hundreds of schools throughout the country, Boyer found little evidence of the goal of emphasizing critical-analytical thought being accomplished:

> In most classrooms, discussion, when it occurs, calls for simple recall . . . serious intellectual discussion is rare . . . how can the relatively passive docile roles of student prepare them to participate as informed, active and questioning citizens? . . . how can we produce critical and creative thinking throughout a student's life when we so systematically discourage individuality in the classroom?

The National Commission on Excellence in Education found that many of our high school students do not possess the "higher order" intellectual skills we should expect of them: nearly 40 percent cannot draw simple inferences, only one-fifth can write a persuasive essay, and only one-third can solve a mathematic problem requiring several steps. This report described our nation as "at risk" and in the process of "unthinking, unilateral disarmament." It called on the schools to equip graduates to comprehend, interpret and evaluate what they read, to write well-organized, effective papers, and to listen effectively and discuss ideas intelligently—all aspects of critical thinking.

The 1985 Council on Economic Development Report, "Investing in Our Children," concluded that:

> Mastery of the old basics of reading, writing, and arithmetic may be sufficient for entry level jobs, but because of the constantly changing nature of work, minimum skills are not sufficient preparation for career advancement. Schools must make a greater effort to develop higher-level skills, such as problem solving, reasoning, and learning ability.

The 1985 NAEP (National Assessment of Educational Progress) Report also concludes that while we have improved the basic reading skills and abilities of our students across the board (increased their ability to read the New York Daily News, for example) their "higher order" reading and thinking abilities have not increased. The number of students who are capable of reading the equivalent of the New York Times is very small, and the number who can handle the equivalent of a technical college textbook is miniscule. These findings continue to support previous NAEP findings that show, for example, that we are not adequately engaging students' interpretive and meaning construction capacities, and that traditional rote learning does not develop the higher order capacities.

John Goodlad, in A STUDY OF SCHOOLING (1984), also found little evidence of critical thinking instruction. He points out that only five percent of instructional time in school is spent on direct questioning of students, and less than one percent of instructional time is devoted to the kind of open questioning that calls for higher level student skills beyond memory:

> It becomes apparent that the range of pedagogical procedures employed in academic subjects is very narrow . . . the teaching observed in our current study was characteristically telling or questioning students, reading textbooks, completing workbooks and worksheets and giving quizzes. This pattern became increasingly dominant with the progression upward from primary to secondary classes.

The Paideia Proposal, (Adler, et.al., 1984) an "educational manifesto" calling for a radical restructuring of the schools, states that:

> an important end of schools is the development of intellectual skills—skills of learning by means of reading, writing, speaking, listening, calculating, problem solving—exercising critical judgments. These skills are the ones everyone needs in order to learn anything, in school or anywhere.

The Paideia group maintains that this does not occur in the present system and contends that there are major errors in the existing educational structure which contribute to this fact. One error the schools too often make is in emphasizing only one kind of teaching and one kind of learning: the didactic process of the teacher talking and the students listening. Their proposal maintains that there are two other kinds (coaching and discussion) and that they are as important as didactic and more effective in developing intellectual skills and enlarging understanding of knowledge.

These three types of teaching and learning are seen as equally important and mutually supportive. Coaching is seen as necessary because well-formed intellectual habits are highly desirable. Socratic teaching and learning, which avoid sophistry, are even more durable. Further (and most helpful in making the case for integrating critical thinking into the school curriculum), the knowledge to be acquired through the help of didactic teaching must be made secure by the skills to be developed by coaching and the understanding through discussion and guided practice.

Another major error the schools make is in thinking that teachers are the sole cause of the learning that occurs in students. The primary cause of learning is the activity of the learner's own mind. Teachers are a secondary cause, an instrumental aid, assisting the process by occasioning and guiding students' mental activity. A recognition of this fact and the fact that we must have all three kinds of teaching and learning *thoroughly integrated* with each other and integrated throughout the K-12 curriculum, is essential. Radical reform is necessary says the Paideia group to eliminate the overwhelming over-emphasis on didactic teaching, which focuses primarily on lower-order thinking skills.

Many of the current reports and studies imply fundamental problems in the status quo. Again and again we are given new evidence about the failure of students to develop crucial "higher level" skills and abilities to critically read, write, speak, listen and reason.

There is also, however, a tendency to idealize the past, to suggest glory days of the past wherein education was "in order" and students "learned as they ought to," and to overemphasize the power teachers have been allowed to exercise. The result is the tendency to suggest that more or less immediate and direct quantitative "cures" can be effected: that it is simply a matter of *more* of one kind of course and *less* of another, or more homework or more time in school. The question should not be simply more standards, but *better* standards.

If an implicit, if not explicit, purpose of education is to "teach" students to think, how has this "unthinking, unilateral disarmament" come to be? Primarily it is due to the fact there never has been an effective systematic emphasis on the development of critical thinking skills. Perhaps the issue is not even disarmament since some would say that schools have never really been "armed." But to date there has never been a concerted, systematic approach to "teaching for thinking."

While critical thinking skills have always been an inherent goal of education, what is new about the current attention to thinking skills, says Resnick, is the aspiration to make thinking and problem solving a regular part of a school program for all or most of the population. "What is new and extremely challenging," she states, "is the notion that everyone, not just an elite, can become a competent thinker." Unfortunately, there are many obstacles to achieving this goal. Teachers have indicated that their college educations prepared them most inadequately for appraising and encouraging the processes of thought. Louis Raths concludes that a "theory of thinking" in teacher preparation has been conspicuous by its absence. Lipman, et.al. (1980) claim that:

> "existing teacher training programs completely fail to prepare the teacher for this responsibility . . . if teachers are to conduct dialogues, they must be provided with the opportunities to engage in philosophical discussions and be exposed to models who know how to facilitate discussions . . . if they are expected to elicit questioning behaviors on the part of their students, they must be taught by educators themselves who model such behavior . . . if teachers

are expected to teach children how to reason, then they must be given practice in reason such as they expect of their students."

Our institutions of higher education simply perpetuate traditional approaches of elementary and secondary education: lecture, memorization and recall. At the present time, there is little or no emphasis on critical thinking in most teacher education programs and no integration of the concepts, dispositions, or skills into education courses. Lecture continues to be the predominant teaching mode. In other words, while most teachers are committed to the concept of inquiry, most literally have had no exposure to comprehensive principles of rational thought and how to infuse them into their curriculum.

The educational system itself is often an obstacle in fostering environments conducive to critical thinking. Given the current organizational constraints on teachers, says Stanford's Larry Cuban (1985), reasoning/critical thinking may be impossible to teach. He claims that how classrooms are staffed, organized and governed within institutional arrangements that stretch from the school to the superintendent's office to the state capital, is an architecture that drives most teachers (but by no means all) toward pedagogies that prize content coverage, recall of information, facile performance on multiple choice test items, and few student questions—approaches that seemingly run counter to the development of reasoning.

Textbooks consistently give meager attention to thinking, and have, in fact, grown less intellectually rigorous over time.

The way we assess student progress has also contributed to the under-emphasis on higher levels of thinking. Benjamin Bloom claims that 95 percent of standardized test questions in the U.S. is devoted to recall and memorization, and neglects the higher level thinking processes. He decries this overemphasis on the lower level thinking skills of recall and rote memory as one out of all proportion to its usefulness or relevance to the development of the individual. Because it is easier to develop tests of information that have statistical reliability, however, curriculum and instruction have become oriented around such tests.

Accountability for student achievement on tests of knowledge has dramatically increased in recent years and with renewed vigor in the current era of educational reform. Standards have been changed, modified, tightened, improved, adapted and increased in desperate efforts to obtain higher achievement scores, frequently with educationally unsound approaches to coerce, induce, or mandate such score increases.* These effort to increase test scores raise an ideological dilemma in terms of critical thinking skills: higher scores and/or higher quality of learning? With advances in the instruments available for testing and measurement, this dilemma need no longer be an obstacle.

In "A Nation Prepared: Teachers for the 21st Century" the Carnegie Forum on Education and the Economy (1986) called, not for the repair, but for the rebuilding of the present educational system. The Forum stated that too many students lack the ability to reason and perform complex, non-routine intellectual tasks and that we are doing better on the old goals often at the expense of making progress on the goals that count the most: "this demands a redefinition of the purposes of schooling, one that goes way beyond the inculcation of routine skills and the acquisition of a stock of facts . . . (people) who think for a living require schools dedicated to the creation of environments in which students become very adept at thinking for themselves."

D. From "Knowledge" to "Knowing"

It is important to stress here that in questioning the traditional reliance of the schools on a one-right-answer model of learning, the critical thinking movement is not denigrating the importance of knowledge in learning. Knowledge is essential and intrinsic to learning of all kinds. One cannot think critically *without* knowledge. When we think, we must always think *about* something. The development of critical thinking, says Cornbleth (1985), is highly knowledge dependent: we cannot think critically about the ideas we encounter unless we know something about the area in question.

There is a difference, however, between memorization and understanding, in moving from "knowledge" and knowing." It is difficult to remember what you do not understand. Much of what we remember is remembered because the information has been place in some context: it has been organized to give it meaning. We need to focus on memory in conjunction with understanding. Memory is not a passively acquired storehouse of information as has been assumed, notes Cornbleth, but an actively constructed more or less organized interpretation of experience She notes that rote memorization is usually an inefficient means of information acquisition and does not promote a functional knowledge base for critical thinking: long-term memory involves the conversion of external information into an internal one. Conversion to "knowing" ranges from superficial rote forms to deeper interpretive ones where we attempt to make sense of or give meaning to experience, often by relating information to what we already know. We develop our "memory" through developing our organized bank of knowledge and understanding.

Much of our essential knowledge is in large part "conceptual." For example, knowledge of the concept of democracy, the ability to use the word and its synonyms effectively and critically, is much more important than rote memorization of isolated facts about a given democracy. Furthermore, random facts about a given nation are themselves best learned, not as miscellaneous items to be committed to memory, but as part of learning general concepts.

A child understands what "democracy" means not only by memorizing the words "government of, by, and for the people," but when she begins to appreciate to what extent it makes sense to apply it and where, and to what extent it does not make sense to apply it. This does not mean only memorizing sentences like "The U.S. is a democracy," "The U.S. has a government ruled by its people," "The people run the government by choosing for whom to vote." You could memorize endless such sentences and not grasp what "democracy" means.

**While the AFT supports standardized testing as an important part of monitoring student progress, we also support improving existing instruments which do not measure higher level critical thinking skills. As the knowledge base on assessing critical thinking skills increases, this information should be put to use in improving the tests. The ETS has already begun this process.*

But suppose the child is asked questions that lead her to reflect upon the situations in her own life in which she is a part of a group that "democratically" decides what happens. Suppose further that situations are described to her in which the arrangement is only partially democratic and she is asked to figure out what is democratic and what is not. By integrating questions which encourage such critical thinking, the student develops a deeper understanding of the concept and will begin to gain more and more skill in the *use* of the concept.

As things stand now, facts are often separate from this sort of basic conceptual learning, yet research indicates that more successful students are more likely to use meaningful rather than rote elaboration strategies. How information is elaborated and organized in memory appears to affect its accessibility and usefulness, says Cornbleth. She notes that in studies of problem-solving skills comparing novices and experts, it has been found that expertise seems to rest on a sophisticated knowledge base of domain-specific and general knowledge, reasoning skills and problem-solving strategies. Teaching for critical thinking *can* help students develop and use meaningful constructions of knowledge and effective strategies for using their knowledge.

E. The Need for a Transportation of Emphasis

Some children are luckier than others in the present system. The "luckiest" learn how to play the game, how to identify and study for what will be expected of them, as well as how to forget the information when they don't "need it" anymore. The less lucky are those children who are not as proficient at memorizing isolated facts but who plod along, figure out some of the rules as they go along, get average test results, and believe for the rest of their lives that they are just average, because that's what their grades implied. Then there are the unfortunate "failures," those children who never learn—or refuse to learn—the rules of the game. These are the children, who after years and years of failure and frustration, internalize their "failure" labels and either rebel or continue to submit in sullen defiance or worse, defeat.

Yet are any of these children lucky? In an environment over-valuing rote learning, will students come to value the authority of their *own* reasoning capacities? Will they learn to reason in a thoughtful and reflective way? Will they learn how to draw inferences, identify assumptions, or challenge one another for reasons? Will they engage in critical intellectual interactions with one another? Aren't these the kind of adults we would hope they would be?

Those students, the lucky and the unlucky, the successes and the failures, all came to school with a natural sense of wonder and inquisitiveness. Somehow that natural wonder gradually diminishes. Need this be so?

Matthew Lipman, developer of a critical thinking program for elementary and high school students, comments on the child's natural wonder and the present system:

> Since our culture characteristically defines intelligence in terms of ability to answer questions rather than the ability to ask them, and in terms of competence in solving problems rather that competency in reorganizing and formulating them, it is little wonder that (thinking) and childhood are thought to be mutually exclusive . . . the intellectual progress typically credited to children occurs, not when they learn to think for themselves, but when we note with satisfaction that the content of their thought has begun to approximate the content of our own . . . If we can somehow preserve their natural sense of wonder, their readiness to look for meaning and their hunger to understand why things are the way they are, then there might be some hope that at least this upcoming generation will not serve as models of unquestioning acceptance to their own children . . .

Of course there is fear on the part of some that if children are encouraged to think and to question, they may question things we don't want them to. To fear the possibility of students questioning is to fear the possibility of students learning. Genuine learning is not something that can be turned on and off like a faucet. You cannot become a learner without becoming a questioner. You cannot learn without considering *ideas*. But every idea conflicts with various other ideas. New ideas conflict with old ones. Many old ones conflict with each other. To accept any idea is to reject the ones inconsistent with it. Learning is a process of accepting and rejecting, finding and abandoning, constructing and reconstructing ideas. To take the questioning out of the process is to kill the process at its heart.

The "critical spirit" or "spirit of inquiry" does not develop automatically. It is a dangerous myth to think that as we grow and mature, thinking and reasoning skills will naturally increase and improve. As Lipman points out, in various studies the mean scores of college freshmen are less than one point above the mean scores of sixth graders on the New Jersey Test of Reasoning skills. In other words, the basic repertoire of reasoning skills of the adult is relatively unchanged from that of a sixth grade child.

Many students get through their basic courses with only superficial understandings of what they have learned, undigested learning which either atrophies or becomes the basis of stereotype or distortion. They develop little ability to apply what they have learned to their own lives and problems. Children "learn" historical facts but do not think historically; they "know" scientific facts but do not grasp how to think scientifically. Lipman states that while thinking is natural, it can also be recognized as a skill capable of being perfected and that to teach critical thinking we need to capitalize on and maximize the wonder and the inquisitiveness that the child initially brings to school. The child who has gained proficiency in thinking skills is not merely a child who has grown, but a child whose very capacity for growth has increased, as children who have been taught to be systematically inquisitive and reflective tend to import such behavior into the rest of their learning.

Our children are faced with the task of coping with a deluge of information in a constantly changing society. The ability to cope with rapid change in an increasingly technological world will require problem solving and analytical skill that an emphasis on critical thinking engenders.

The complexity and the challenges of the social, political and personal issues of the day do not submit to incidental learning. They demand the use of independent thought, reasoned judgment and the ability to think analytically and rationally. "Decisions on crucial issues," says Michael Scriven, "are being made by people who are ignorant of the relevant facts and untrained in coping with controversial issues. Remedying this is the primary task of training in critical thinking and such training should be the primary task of education."

F. The Emergence of the Critical Thinking Movement in Education

Critical thinking, then, while often considered to be a central ideal of the educational endeavor, has not fully taken root in the reality of the educational process, but there is now a robust critical thinking movement developing. California, for example, is one of a number of states said to be at the very beginnings of a series of reforms in this direction. The college and university systems in California have instituted a graduation requirement in critical thinking for *all* students. The California State Department of Education has initiated a series of reforms in critical thinking in the elementary and secondary schools, including projected revisions in textbooks, curriculum, staff development and teacher education. The state is presently developing new tests in language arts, math and social studies in which from 30 to 60 percent of the items will be designed to test critical thinking skills. Many other states are incorporating critical thinking in statewide curricula and testing programs.

In 1985 the AFT conducted a 50-state survey of critical thinking initiatives being developed by State Departments and Boards of Education. The responses yielded a range of initiatives on the issue from no activity, to legislation mandating the teaching of critical thinking skills (California, South Carolina, Wisconsin, Connecticut, New York, Texas), to state level recommendations, conferences, surveys, newsletters and teachers' guides (Pennsylvania, Vermont, New York). Of the 50 states queried, twenty-eight responded. Many responses suggested an assumption that critical thinking was automatically occuring in the schools:

> ". . . not currently involved in 'critical thinking' as a separate issue . . ."
>
> ". . . this is a high priority skill hopefully identified in all content areas . . ."
>
> ". . . to date we have not published any formal statement related to critical thinking, but assume that the importance of critical thinking will be addressed in ongoing curriculum development projects . . ."
>
> ". . . there is no current state level activity directed to this area. We believe that critical thinking skills are incorporated into teaching strategies in many curriculum areas . . ."
>
> ". . . critical thinking skills are believed to be part of the curriculum frameworks developed in all subject areas . . ."
>
> ". . . the state has not made any recommendations or mandates in the area of developing critical thinking skills . . ."

Twenty-seven states reported that they are now taking steps to initiate reforms geared to bolstering students' thinking skills. For example:

Connecticut

There is draft legislation which recommends that:

> "Instruction in all areas should be designed to foster thinking skills such as recognition of facts, critical reasoning and problem solving."

The Department of Education is developing mastery tests for 4th-, 6th-, and 8th-grade students with items within the content areas that focus on reasoning skills.

New York

The action plan adopted in 1984 includes generic changes in instruction, one of which is to "ensure that all students are learning to think logically and creatively and to apply reasoning to issues and problems in all subjects at all grade levels." The plan states that nothing is more important to the quality of what students learn than the extent to which they learn to think in disciplined ways about what they study. The Education Department (working with teachers and administrators) is identifying specific reasoning and problem-solving skills with specific sequential student objectives for all relevant subjects at all grade levels to ensure that students acquire these skills and learn to apply them within the subjects they study and to issues and problems in life outside school.

Pennsylvania

Thinking is one of the state's 12 educational goals. A statewide survey on thinking is being conducted and 100 schools with thinking programs have been identified. Additionally the state has developed a newsletter, will be co-sponsoring a conference on "The Student As Thinker" and will be publishing a resource guide.

South Carolina

The legislature passed an Education Improvement Act (1984) which provides that:

> "Section 4. The State Department of Education and all school districts shall emphasize higher order problem-solving skills in curricula at all levels."

Wisconsin

The state enacted a statute s.118.01(2)(a)2, with the following requirement for students:

> "Analytical skills, including the ability to think rationally, solve problems, use various learning methods, gather and analyze information, make critical and independent judgment and argue persuasively."

Critical thinking, while addressed in some way in most recent reform reports, has not been a major issue in the first wave of reform efforts at the state and local levels. Yet these responses to AFT queries suggest the beginnings of a major critical thinking movement. One crucial issue is who is going to direct the movement? Real leadership on this issue in education is beginning to emerge. One promising initiative is a collaborative effort of 20 national educational organizations interested in promoting student thinking as a priority. This collaborative was launched by the Association for Supervision and Curriculum Development (ASCD) and is examining the ways that such organizations working together can have a positive influence on the direction of the movement and prevent it from becoming another educational fad. A "National Council for Excellence in Critical Thinking" is being established by the Center for Critical Thinking at Sonoma State University in California which runs an annual international multidiscipline K-U conference on Critical Thinking and provides in-service training and resources to schools. This council has a membership that crosses disciplinary boundaries. The University of Massachusetts at Boston boasts the only masters degree program for teachers in critical and creative thinking, and the Illinois Thinking Project, located at the University of Illinois, Champaign-Urbana, is increasing its research and consultation efforts.

Reform efforts by politicians and state legislatures raise an ideological dilemma for the teaching profession: either to be reactive, and accept reforms in this and other areas imposed by others (governors, legislators, business people and state school superintendents) or, as a true profession, to take a proactive, leadership role in defining the necessary changes to take place in education. The AFT believes that teachers have to be involved and provide leadership in defining our profession and our practice. The profession needs to play a leading role in the development of critical thinking initiatives to ensure the sound development of such programs.

In the chapters to follow, we will examine the issues related to such leadership, the issues related to transforming critical thinking from educational ideal to educational reality. The following sections include: **CRITICAL THINKING: DEFINING THE CONCEPT, TEACHING CHILDREN TO THINK FOR THEMSELVES, ASSESSING AND EVALUATING CRITICAL THINKING SKILLS,** and **RECOMMENDATIONS FOR POLICY AND PRACTICE.**

CHAPTER 2: CRITICAL THINKING: HOW THE CONCEPT IS DEFINED AND WHAT THE RESEARCH SAYS

A. Approaches to the Concept of Critical Thinking

Defining critical thinking can seem as challenging as defining love. The "critical spirit" is composed of attitudes (or dispositions) *and* skills, both of which are essential to the process. Simply mastering a set of discrete thinking skills (recognizing assumptions or drawing conclusions, for example) does not a critical thinker make. This would be critical thinking in the "weak sense" merely learning the micro-skills. Critical thinking in the "strong sense" occurs when both the skills and dispositions are integrated and intrinsic ultimately to the character of a person. It is knowing not only how, but *when* to question something and knowing what kinds of questions to ask.

As described in Chapter 1, this critical spirit is an *attitude* toward inquiry, a *knowledge* of the methods of reasoning and inquiry, and *skill* in applying them. This is akin to Dewey's description of reflective thought as "active, persistent and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends."

Cornbleth (1985) identifies the essence of critical thinking as informed skepticism, as active inquiry rather than passive acceptance of tradition, authority or "common sense." "It is," she says, "a dynamic process of questioning and reasoning, of raising and pursuing questions about our own or others' claims and conclusions, definitions and evidence, beliefs and actions." She rightly notes that critical thinking is not limited merely to the evaluation of statements or arguments, as some narrower views have it, but that, depending on the situation, it involves question raising, seeking information, reasoning, evaluating options, reflecting on one's thinking, and raising and pursuing further questions. The concept is used in its broadest sense here. While critical thinking is not necessarily synonymous with all thought processes beyond memory, or problem solving, or decision making, or the scientific method, or reasoning, critical thinking skills used fairmindedly underlie, overlap and complement these processes. "All thought processes beyond memory" could include creative thinking which involves some elements of critical thinking (ideas once generated need to be evaluated for the best possible combinations) and some unique unto itself (generating the ideas). Problem-solving theory involves a series of steps from problem to solution. Critical thinking encompasses these steps, but it also goes beyond procedural thinking and cannot be reduced to a formula or list of steps to follow because it is also generative and creative. The scientific method consists primarily of verification skills whereas critical thinking is a broader concept that includes additional skills. Reasoning involves inferring from premises to conclusions, while critical thinking encompasses this process and also includes such skills as assuming and interpreting.

The concept of critical thinking used here, while not synonomous with creative thinking, emphasizes the use of imagination and the attitudes and skills that are common to both.

There is a danger, however, in separating critical thinking from creative thinking, says Robert Swartz, Co-Director of the University of Massachusetts at Boston's master's degree program in Critical and Creative Thinking. He says that in developing good thinking skills, students must also develop a sense of where these skills can be most appropriate and effectively used in dealing with problems and issues that call for clear thinking. "We should stand back from these 'skills' approaches and look holistically at good thinking . . . taking a broader perspective means that these lists (e.g., critical thinking, creative thinking, problem solving, decision making) should be viewed as complementing each other . . . in situations where they are best used, the norm, not the exception is to use them in combination, not in isolation."

Seeking an explanation of some event, for example, will be furthered if we consider a number of possible explanations (creative thinking) and sort out the best ones (critical thinking).

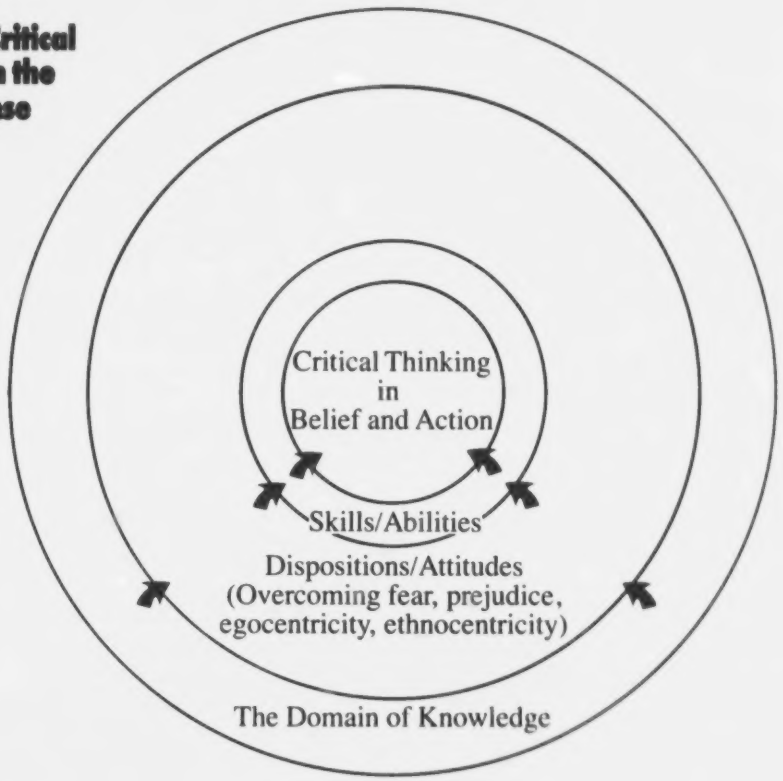
This conception of critical thinking is eclectic in the sense that it draws on several disciplines for their contributions to the knowledge on this issue: the social sciences, philosophy, cognitive science and psychology. Theory and research on problem solving, cognition, metacognition (thinking about thinking), or the inquiry method, all contribute something to our understanding of thinking skills in general, and critical thinking in particular. These contributions are included throughout this discussion.

In summary then, the concept of critical thinking as used here can be defined as fairmindedly *interpreting, analyzing or evaluating information, arguments or experiences with a set of reflective attitudes, skills and abilities to guide our thoughts, beliefs and actions.* This conceptualization can be illustrated by the model in Table 1.

B. Critical Thinking Dispositions and Attitudes

> "The importance of critical thinking can best be evaluated by the undesirable attitudes and beliefs it would eliminate. Biases and prejudices distort the perceptive and reasoning abilities of students to appraise situations, beliefs and arguments accurately." (D'Angelo, 1971)

Table I - Model of Critical Thinking in the Strong Sense



Thinking critically begins with an attitude of being disposed to consider in a thoughtful, perceptive manner the problems and subjects of one's life. In thinking about infusing critical thinking into schooling, it is as important to consider, emphasize, model and encourage this attitude—the critical thinking dispositions—as well as the skills in classroom instruction.

An attitude is a mental posture; a disposition a natural tendency. D'Angelo (1971) identifies the following attitudes as necessary conditions for the development of critical thinking:

1. **Intellectual Curiosity.** Seeking answers to various kinds of questions and problems. Investigating the causes and explanations of events; asking why, how, who, what, when, where.

2. **Objectivity.** Using objective factors in the process of making decisions. Relying on empirical evidence and valid arguments, and not being influenced by emotive and subjective factors in reaching conclusions. (Objectivity can be confused with neutrality, however. It is not necessary that one be neutral to freedom over tyranny, for example, or to the rule of the law over rule of the mob in order to be objective and accurately describe these different systems and their human consequences.)

3. **Open-Mindedness.** A willingness to consider a wide variety of beliefs as possibly being true. Making judgements without bias or prejudice.

4. **Flexibility.** To be willing to change one's beliefs or methods of inquiry. Avoiding steadfastness of belief, dogmatic attitude, and rigidity. A realization that we do not know all the answers.

5. **Intellectual Skepticism.** Postponing the acceptance of a conclusion as being true until adequate evidence is presented.

6. **Intellectual Honesty.** The acceptance of statements being true when there is sufficient evidence, even though it negates some of our cherished beliefs. To avoid slanting certain facts to support a particular position.

7. **Being Systematic.** Following a line of reasoning consistently to a particular conclusion. Avoiding irrelevancies that stray from the issue being argued.

8. **Persistence.** To persist in seeking ways of resolving disputes. Supporting certain points of view without giving up the task of finding evidence and arguments.

9. **Decisiveness.** To reach certain conclusions when the evidence warrants it. To avoid unnecessarily drawn out arguments, snap judgments, and delays in reaching decisions until all necessary information is obtained.

10. **Respect for Other Viewpoints.** A willingness to admit that you may be wrong and that other ideas you do not accept may be correct. Listen-

ing carefully to another point of view and responding accurately to what has been said.

We need to examine the way that our educational system, as currently designed, either fosters or inhibits these attitudes in our students and ultimately define the purpose and goal of schooling. Olson (1985) describes present schooling as "obedience training:" "Education tends to teach us to conform; to solve non-creative problems (those with the answer at the back of the book); to reward coming up with an idea and not taking the action required to implement our idea. It makes us trust written material such as books too much; leads us to believe that others who are more wise have the real answers and separates learning from doing . . . our educational system leads us to believe that failure is wrong and of no value."

Many of these accusations have validity. When the system overemphasizes content coverage, performance on standardized tests which primarily measure the lower order thinking skills of recall and rote, and unquestioning acceptance and docility in students, then that is what the schools will continue to produce.

Other obstacles to effective and creative thinking include habit, limited availability of time, need for immediate solutions, criticism by others, fear of failure, and complacency. Much of our thinking is subconscious and automatic and is based on our conditioning and biases. We hear only what we want to hear, and believe only what we want to believe. Irrational thinking is based on self-deception, fear and selectivity of information to fit our beliefs. Habits are reactions and responses which we learn to perform automatically without having to think and decide. It is usually very hard and uncomfortable to change bad habits.

An emphasis on rational thinking versus irrational thinking in school and throughout life can help students recognize self-deception, selectivity of information, and the fallacious arguments of others. Rational thinking is based on evidence and fair-minded thought. It involves learning the bases of our ideas—their motivational sources. It involves going beyond looking just for the evidence to support our beliefs, being able to analyze arguments and assess the validity of conclusions, being able to reason fairly within opposing viewpoints.

One's approach to the world, or "world view" is a philosophy or set of background beliefs which provide a filter through which we perceive the world. Reasoning based on a distorted or inaccurate world view yields distorted and inaccurate conclusions no matter how good our reasoning, says Kahane (1983). There is a difference between thinking critically and using critical thinking skills. The skills can be used to support prejudices and narrow-mindedness unless we learn how to identify our point of view and protect against just assuming its correctness. Reasonable people have always differed seriously in their world view even when they are exposed to the same evidence. It is their *use* of the evidence that fits their world view that makes a difference. What people remember about an episode is the product of their own construction of the world, their experiences, attitudes and expectations.

The schools should play the vital role of helping students develop accurate world views so that they may be able to assess information accurately and fairly, whether it be a history lesson or an incident in their daily lives, thereby becoming more aware of and hopefully reducing the effects of bias, prejudice and self-deception in their thinking.

Schools need to begin to explode the myth of the "one right answer" as part of its effort to foster critical thinking. This myth simply misrepresents the real world where many questions do not have right—or even good—answers. There are issues in the logically messy "real world" of everyday life where one has to deal with opposing points of view and contradictory lines of reasoning. This requires a willingness to listen and analyze contending perspectives on an issue. Not all issues can be reduced to a single point of view. This type of "reasoned judgment" is akin to the jury we expect to enter empathetically into the arguments of both the prosecution and defense. We want the strongest possible case to be made on both sides. The schools can work toward developing such reasoned judgment. This need is perhaps the most challenging since these dispositions and skills are not acquired naturally, automatically.

We may also need to reexamine an environment where mistakes are equivalent to sins, the impact of this environment on risk-taking with one's thoughts and ideas, and the role that competition plays in fostering or inhibiting critical thinking. In some experimental studies specifically designed to reduce competitiveness and increase cooperation in learning (Johnson and Johnson, 1981), cognitive outcomes included retention, application and transfer of information, concepts and principles; problem-solving ability and success; creative ability; and divergent and risk-taking thinking. Affective outcomes included acceptance and appreciation of cultural, ethnic and individual differences; reduction of bias and prejudice; pluralistic and democratic values; valuing education; and positive attitudes toward school and self.

Raths says that when teachers emphasize thinking in conjunction with subject matter, students' thinking improves and learning is enhanced. When there is an acceptance and discussion of the thinking of students, they become less dogmatic, less rigid, less impulsive and will suspend judgment and deliberate and examine alternatives before reaching a conclusion.

Robert Ennis, Professor of Education and Director of the Illinois Thinking Project at the University of Illinois, Urbana-Champaign, who has been engaged in the study of critical thinking ability (what it is and how to teach and test for it) since the mid-1950s has developed what he calls "Goals for a Critical Thinking/Reasoning Curriculum" (1985). His definition of critical thinking ("reasonable and reflective thinking that is focused on deciding what to believe and do") involves both dispositions and abilities. The essential dispositions he has identified for thinking critically are the tendency to:

1. Seek a clear statement of the thesis or question
2. Seek reasons
3. Try to be well informed
4. Use credible sources and mention them

5. Take into account the total situation
6. Try to remain relevant to the main point
7. Keep in mind the original and/or basic concern
8. Look for alternatives
9. Be open-minded
   a. Consider seriously other points of view than one's own (dialogical thinking)
   b. Reason from premises with which one disagrees—without letting the disagreement interfere with one's reasoning
   c. Withhold judgement when the evidence and reasons are insufficient
10. Take a position (and change a position) when the evidence and reasons are sufficient to do so
11. Seek as much precision as the subject permits
12. Deal in an orderly manner with the parts of a complex whole
13. To be disposed to use the listed critical thinking abilities
14. Be sensitive to the feelings, level of knowledge, and degree of sophistication of others.

These dispositions and attitudes must be included in any approach to infuse the curriculum with thinking skills. They can be modeled, discussed, emphasized, their use rewarded, their misuse identified. Teachers have incredible power and this "affective" component of teaching for thinking is as important as the cognitive. Kahn and Weiss (1973), for example, have found that it is the quality of certain teacher interactions that determine the degree of trust, risk-taking, level of cognition, warmth, rapport, openness and psychological safety in the classroom. Lowery (1979) even found that the way the teacher responds is more influential in determining students' behavior than what the teacher asks or tells the students to do. We know that children acquire much of their behavior, feelings, attitudes and values through imitation of significant adults in their lives. Teachers can use this power to transform their classrooms into true communities of inquiry.

Paul (1982, 83, 86) has written a series of articles which stress the need to link curricular reform with a special emphasis on dialogical thinking. In this model students learn to role-play and reason within opposing points of view, both with respect to disciplinary issues and those which go beyond or cross disciplinary lines. He calls this kind of thinking multi-logical (in crossing domains and points of view) and contrasts it with monological thinking (thinking that is exclusively within one point of view or belief system).

Paul argues that most present instruction, most text books, and most student thinking are monological while most of the important issues of everyday life are multilogical. He argues that prejudice, bias, and irrationality can be overcome only by cultivating the art of thinking dialogically.

Paul developed an explicit, "strong sense" approach to critical thinking. By creating opportunities for students to reconstruct the points of view of others, Paul believes simultaneous intellectual and affective growth will be significantly promoted. He, like Piaget, believes that empathetically entering into the reasoning that supports beliefs other than our own and experiencing the case that can be made for and against them dialogically helps the student to separate his identity from the particular *content* of beliefs. He encourages students to focus instead on the *process* of rationally establishing their beliefs, encouraging them to develop a conception of themselves as open to new and different ideas and not as uncritically *fixed* in any beliefs. For Paul whether or not students ego-identify with particular beliefs (become so personally identified with them as to perceive a challenge to them as a challenge to themselves) is a crucial determinent in whether or not they have learned to think critically in the strong sense.

To maximize this kind of global change, Paul emphasizes providing students with micro-skill practice in the midst of macro-ability use. He reduces micro-skill drill to a minimum and focuses classroom activities on major macro-abilities: 1) the ability to question Socratically (students learn how to question each other's beliefs and reasons, probing for evidence, reasons, assumptions, implications), 2) the ability to reconstruct the thinking of others (reciprocity), and 3) the ability to engage in the give-and-take of intellectual exchange (students learn not how to score points or to defeat other perspectives, but rather how to gain a clearer grasp of strengths and weaknesses within opposing viewpoints). Paul views egocentricity and sociocentricity as the major impediments to strong sense critical thinking. His emphasis on dialogical assignments and dialogical teaching is designed to break down these deep-seated structures and make possible the development in the student of a more "rational" self.

The significance of the dialogical approach is suggested by recent studies by David Perkins of Harvard who found that there was no significant correlation between intelligence and open-mindedness. He found that intelligent people have as strong a tendency to closedmindedness as those less intelligent. His conclusion is that if we want open-mindedness we need to teach for it through something like a dialogical approach. This point is further illustrated by a recent study of attitudes toward dissent among West German youth, reported by Summers, *et.al.* (1986):

> "The central finding of this study was that young people who showed high tolerance for viewpoints different from the majority on specific subjects had been more exposed to controversy or conflict than those who had little tolerance for dissenting views. Even more to the point, the greater the reported frequency with which controversial topics had been entertained in classrooms, the higher the tolerance of students toward dissenting viewpoint."

Jack Easley has pioneered the application of dialogical instruction to the domains of math and science, arguing that even when issues are monological it is essential for children to build their understanding of them through classroom instruction that is dialogical:

> "Those few students who do truly master mathematical or scientific subjects do so through a long pro-

cess of doubting and challenging authority . . . Teachers of regular primary grade classes should train group leaders on a regular basis to provide appropriate challenges for every member of their group . . . Primary children should strive first to develop expression in some form by working in heterogeneous groups, trying to convince each other by clear speaking and writing . . . As children discover they have different solutions, different methods, different frameworks, and they try to convince each other, or at least to understand each other, they revise their understanding in many small but important ways."

Paul asserts there is a pressing need to develop more curriculum which emphasizes multi-logical issues as well as classroom strategies that focus on dialogical reasoning, and that only when more classroom emphasis is place on dialogical thinking will we be able to fully appraise its potential impact.

C. Critical Thinking Skills and Abilities

Ralph Johnson and Anthony Blair, two leaders in the critical thinking movement from the University of Windsor, Canada have integrated the disposition/skills parallel by describing the critical thinker as a person who is disposed to ask the following questions and has the skills to pursue their answers:

1. Is it clear? (What does it mean?)
2. Is that right? (true? plausible? likely?)
3. How can anybody know that?
4. What is the evidence for it?
5. What is the negative evidence for it? (What other possibilities are there?)
6. What are its implications? (or consequences?)
7. What are the unstated assumptions at work here? (Johnson and Blair, 1985)

The abilities that Ennis identifies are classified according to five different categories:

I. **Elementary Clarification**
   1. Focusing on a question
   2. Analyzing arguments
   3. Asking and answering questions of clarification

II. **Basic Support**
   4. Judging the credibility of a source
   5. Observing and judging observation reports

III. **Inference**
   6. Deducing and judging deductions
   7. Inducing and judging inductions
   8. Making and judging value statements

IV. **Advanced Clarification**
   9. Defining terms and judging definitions
   10. Identifying assumptions

V. **Strategy and Tactics**
   11. Deciding on an action
   12. Interacting with others

A summarization of many current lists of critical thinking skills would include the following skills:

1. Identifying central issues
2. Recognizing underlying assumption
3. Recognizing stereotypes and cliches
4. Recognizing bias, ethnocentricity, propaganda, or emotional factors in a presentation
5. Distinguishing between verifiable and unverifiable data
6. Distinguishing between relevant and nonrelevant data
7. Distinguishing between essential and incidental
8. Recognizing the adequacy of data
9. Determining whether facts support a generalization
10. Checking consistency
11. Drawing warranted conclusions or inferences
12. Formulating or evaluating hypotheses
13. Reference skills
14. Evaluating reliability of data
15. Distinguishing facts from opinion and reasoned judgment
16. Determining validity or soundness of an argument
17. Judging whether a theory is warranted
18. Exhibiting explanatory skills
19. Judging whether a statement is overvague or overspecific
20. Comparing similarities and differences among ideas or events
21. Classifying items according to rational criteria
22. Making informed judgments
23. Drawing applications to a different context
24. Relating cause and effect
25. Making decisions
26. Evaluating questions
27. Building theories

(California Assessment Program (CAP), California State Department of Education, 1984)

An emphasis on these skills and abilities is quite different from the current emphasis in most schools. School practices have resulted in teachers for the most part using the expository, or didactic mode of teaching (telling, explaining, showing). The teacher is active, the student passive. While these techniques are important, fostering thinking skills further requires that students actively *do* something with the information. Knowledge presupposes comprehension and rational assessment.

The question is, however, how do we move from a list or lists of critical thinking skills to actual "infusion" of these skills into the various disciplines and at the various age and developmental levels of our students? While specific teaching strategies and examples will be described in Chapter 3, it may be useful at this point to study one example of a state-wide effort to identify and define critical thinking skills at various grade levels K-12 to provide an

overall framework for educators from which to work thereby building some continuity into school-wide or district-wide approaches to teaching for thinking.

As mentioned, California is considered to be at the beginning of a series of reforms directed toward enhancing students' critical thinking skills. An advisory committee using member input, the state's curriculum framework, teacher survey results and consultation with prominent critical thinking experts, identified skills that they perceived as essential for critical thinking. According to Kneedler (1984), the skills are presented as elements of a much larger process in solving problems or reaching conclusions. Though the skills are presented serially for clarity and understanding, there is a recognition that students do not necessarily think this way—that these and other skills are used in a variety of combinations to solve problems.

Tables I - V illustrate the skills and levels of their use at grades 3, 6, 8, 10 and 12. The skills that were decided upon are clustered into three broad categories: *Clarifying issues and terms, judging and utilizing information, and drawing conclusions*. The generic skills remain the same throughout the grade levels but the levels of sophistication and transfer are expected to progressively develop.

Under clarifying issues and terms there is the following sequence:

3rd grade - makes careful observations

6th grade - can distinguish clear from unclear formulations of simple issues or problems

8th grade - can identify central issues or problems

10th grade - can delineate controversial components

12th grade - can distinguish real and unstated problems

Under judging and utilizing information:

3rd grade - identifies obvious stereotypes

6th grade - understands the idea of a stereotype and cliche

8th grade - can recognize stereotypes and cliches

10th grade - can recognize subtle manifestations of stereotypes and cliches

12th grade - can distinguish between images and reality

And finally, as an example of skill in drawing conclusions:

3rd grade - recognizes the adequacy of data

6th grade - understands the idea of drawing conclusions from evidence

8th grade - can identify reasonable alternatives

10th grade - can justify the selection of an alternative

12th grade - can generate reasonable alternatives

While listing essential skills involved in critical thinking is helpful, a problem with lists, steps and procedures is that they imply that critical thinking is or should be linear and step-by-step which it rarely, if ever, is. The kind of questioning and the means to pursue the answers depend to a major extent on the situation: the ideas encountered, the social context of the encounter, and the prior knowledge and values of the questioner. Critical thinking, concludes Cornbleth, cannot be reduced to a universally applicable formula of skills or steps to follow but is a creative or generative process in ways analogous to writing or sculpting.

Thinking *is* natural, but unfortunately critical thinking is not. It is a skill capable of being perfected. It is also a matter of degree. No one is without any critical skills whatsoever and no one has them so fully that there are no areas for improvement. It is also important to remember that critical thinking is not the equivalent of intelligence. Persons of average intelligence can be trained to use their mental ability more productively. The evidence suggests that these skills and abilities *can* be taught, that critical thinking skills can increase academic success, and that the earlier the skills are incorporated throughout a child's education the better.

Table I - Third Grade Critical Thinking Skills

I. Clarifying Issues and Terms

A. Makes careful observations
B. Identifies and expresses main idea, problem, or central issues
C. Identifies similarities and differences
D. Organizes items into defined categories
E. Defines categories for unclassified information
F. Identifies information relevant to a problem
G. Formulates questions
H. Recognizes different points of view

II. Judging and Utilizing Information

A. Identifies obvious stereotypes
B. Distinguishes between fact and opinion
C. Identifies and explains sequence and prioritizing
D. Identifies evidence that supports (or is related to) a main idea
E. Identifies obvious assumptions
F. Identifies obvious inconsistency and contradiction
G. Identifies cause and effect relationships

III. Drawing Conclusions

A. Recognizes the adequacy of data
B. Identifies cause and effect relationships
C. Draws conclusions from evidence
D. Puts simple hypotheses into "if, then" sentences

Table II - Sixth Grade Critical Thinking Skills

I. Clarifying Issues and Terms

A. Can distinguish clear from unclear formulations of (simple) issues and problems
B. Notes obvious similarities and differences
C. Understands the concept of relevance and irrelevance
D. Can recognize simple appropriate and inappropriate questions
E. Able to express problems and issues
F. Can recognize obvious individual and group value orientations and ideologies

II. Judging and Utilizing Information

A. Understands the idea of a stereotype and cliche
B. Understands the idea of bias, propaganda, semantic slanting
C. Understands the idea of fact, opinion, and reasoned judgment
D. Understands the idea of inconsistency and contradiction
E. Understands the idea of assumption
F. Understands the idea of evidence

IV. Drawing Conclusions

A. Understands the idea of drawing conclusions from evidence
B. Understands the idea of predictory consequences
C. Understands the concept of hypothesizing
D. Can put simple hypotheses into "if, then" sentences
E. Understands the idea of an analogy, and a generalization
F. Understands the idea of implication

Table III - Eighth Grade Critical Thinking Skills

I. Clarifying Issues and Terms

A. Can identify central issues or problems
B. Can identify similarities and differences
C. Can determine which information is relevant
D. Can formulate appropriate questions
E. Can express problems clearly and concisely
F. Can recognize individual and group value orientations and ideologies

II. Judging and Utilizing Information

A. Can recognize stereotypes and cliches
B. Can recognize obvious bias, emotional factors, propaganda and semantic slants
C. Can distinguish among fact, opinion and reasoned judgment
D. Can recognize simple inconsistencies and contradictions
E. Can recognize simple unstated assumptions
F. Can recognize clearly insufficient data

III. Drawing Conclusions

A. Can identify reasonable alternatives
B. Can predict possible consequences
C. Can test conclusions or hypotheses
D. Can reason hypothetically
E. Can identify causal claims/generalizations/analogies
F. Can recognize immediate implications

Table IV - Tenth Grade Critical Thinking Skills

I. Clarifying Issues and Terms

A. Can delineate controversy components
B. Can identify criteria that best organizes data
C. Can identify fallacies or relevance
D. Can formulate appropriate questions
E. Can paraphrase accurately
F. Can distinguish among diverse viewpoints

II. Judging and Utilizing Information

A. Can recognize subtle manifestations of stereotypes and cliches
B. Can recognize subtle manifestation of emotional factors, propaganda and semantic slants
C. Can distinguish among fact, opinion, and reasoned judgment in subtle cases
D. Can recognize subtle or indirect inconsistencies
E. Can recognize subtle or "buried" assumptions
F. Can recognize subtle differences in judging the sufficiency of data

III. Drawing Conclusions

A. Can justify the selection of an alternative
B. Can distinguish between possible and probable consequences
C. Can tailor conclusions strength to evidence
D. Can reason within opposing points of view
E. Can recognize fundamental problem in causal claims/generalizations/analogies
F. Can recognize indirect or extended implications

Table V - Twelfth Grade Critical Thinking Skills

I. Clarifying Issues and Terms

A. Can distinguish real and stated issues
B. Can identify the most satisfactory interpretation of data
C. Can determine degrees of relevance
D. Can formulate appropriate questions
E. Can articulate positions and support
F. Can compare political economic, legal and social systems

II. Judging and Utilizing Information

A. Can distinguish between images and substance
B. Able to write sentences and material into "unbiased" form
C. Able to use facts, opinions, and reasoned judgments in an effective manner in speeches and writing
D. Demonstrates a sensitivity to subtle inconsistencies in reading and writing
E. Demonstrates a sensitivity to questionable assumptions in reading and writing
F. Demonstrates an ability to marshall data and use it effectively in coming to reasoned judgments

III. Drawing Conclusions

A. Can generate reasonable alternatives
B. Can anticipate desirable and undesirable consequences
C. Demonstrates the ability to come to a reasoned judgment in reading, writing, and speech
D. Demonstrates a sensitivity to the "strongest" forms of opposing points of view
E. Can develop and assess causal claims
F. Can develop an extended line of reasoning, taking into account problematic implications

(CAP, 1984 reprinted with permission).

D. Research on Critical Thinking Issues

The research on critical thinking and related issues (decision making, problem solving, etc.) is diverse but substantial. Little attention, however, has been given to related research on classroom practice (teaching and assessment). There appears to be an urgent need for useful research in this area. The available data, now, suggests 1) that the earlier critical thinking skills are introduced, the better; 2) that instruction in critical thinking correlates with increases on tests of thinking and reasoning, and 3) that instruction in critical thinking has also resulted in increased student achievement in academic subjects.

As early as 1919, studies of children, ages 7 through 14, that incorporated items and problems designed to test reasoning abilities, found that 7-year olds seem to possess all the fundamental abilities required to reason successfully. White, in 1936, when testing the significance of logic and reasoning instruction with 12-year olds, found evidence of applicability and demonstration of transfer of learning from the training material to a typical school task (writing an essay). He found that grammar, if supplemented by instruction in reasoning, could improve the learner's quality of written expression.

Fawcett (1938) embarked on a two-year project teaching critical thinking in geometry. The study was based on the assumption that if critical thinking ability was to be improved and extended to non-mathematical activities as well, experiences in the classroom must highlight the basic continuity of thinking processes across activities. The teacher continuously shifted from the mathematics text to applications to everyday life. As a result, the students scored at the 80th percentile in geometry achievement, even though less time was devoted solely to geometry curriculum. The students also demonstrated significant improvement in reasoning skill.

In 1941, in an experiment in the development of critical thinking, Glaser (co-author of the Watson-Glaser Critical Thinking Test) studied the effects of an eight-week program of instruction for secondary students. He found significant improvement in the scores of experimental classes on tests of critical thinking.

D'Angelo (1971) has identified the following seven studies as having made a contribution to our knowledge of integrating critical thinking into the content areas:

> Blair and Goodson (1939) conducted an experiment using two different teaching methods to develop scientific thinking in general science. Three groups of ninth grade students were involved in the study. The science and non-science control groups were taught by traditional methods, and the experimental group was taught by procedures designed to promote scientific thinking. The students in the experimental group were given exercises to determine the assumptions in statements, hypotheses and conclusions warranted by the available facts, the testability of certain hypotheses, and the analysis of advertisements in terms of definitions, assumption, and arguments. The Noll **What Do You Think?** test was used to measure growth in scientific thinking. The results of this experiment showed that the experimental group made significantly higher scores on the Noll test than the science and non-science control groups. It was concluded that the study of general science does not in itself contribute to the fostering of scientific thinking. Improvement in scientific thinking is achieved in general science courses when experiences and exercises are provided in the classroom to achieve this objective.

Ulmer (1939) conducted an experiment in seven high schools with 1239 students to determine the effects of using a reflective method in the teaching of geometry. This study involved an experimental group and two control groups. The experimental group consisted of students in geometry classes where the emphasis was placed on studying the principles of critical thinking in both geometric and non-geometric situations. The geometry control group studied geometric facts and relationships without the emphasis on critical thinking. The non-geometry control group consisted of students who were not studying geometry. The results of the test showed there was no measurable gain in critical thinking in the non-geometry control group, a slight gain in the geometry control group, and a considerable gain in the experimental group. This study also indicated that high school geometry teachers can teach to promote critical thinking without sacrificing an understanding of geometric facts and principles.

Suchman (1963) investigated the procedures for teaching the skills of scientific inquiry to elementary school students. This is sometimes known as inquiry training. The purpose of inquiry training in this experiment was to focus on the process of inquiry in processing data, verifying hypotheses through verbalized experiments, isolating variables, and investigating causal relationships. The aim of this study was to determine whether inquiry training produced changes in the method students used in the process of inquiry. Twelve teachers were trained in inquiry training during an eight-week summer session. The following school year these teachers conducted a twenty-four week program of inquiry training with groups of children in their schools. The experimental group was given inquiry training, while the control group was taught by expository and didactic methods. This study showed that the gains made by the experimental group in mastering inquiry skills were greater than the control group at a level of significance just short of .05. It was concluded that inquiry training does produce significant procedural changes in the scientific inquiries used by elementary school students.

Kastrinos (1964) compared the effectiveness of two methods of teaching biology relative to developing critical thinking in the classroom. The students involved in this experiment were high school juniors and seniors who were enrolled in an advanced biology course. Two groups were used in this study, and they were taught by different

methods. The textbook-recitation group was taught by means of recitations and lectures that emphasized factual materials in the textbook. The principles-critical thinking group was taught with the emphasis on concepts and principles. The problems that were analyzed required the use of such skills as a recognition of the nature of the problem, an evaluation of the data, and the use of the scientific method. There were no significant differences between the two groups in their mastery of the factual material, however, the principles-critical thinking group had a signficantly higher mean score than the other group on a critical thinking test constructed by Kastrinos.

Cousins (1963) conducted a study to determine whether students in an eighth grade social studies class could master certain critical thinking skills when the class was taught by the reflective method. The model of critical thinking included defining key terms, evaluating generalizations, validating cause and effect relationships, and tracing logical deductions. Gains in critical thinking were measured by the **Watson-Glaser Critical Thinking Appraisal,** the **Cooperative Social Studies Test for Grades 7, 8, 9** and a special test constructed by the teacher. Statistical analyses of the scores on these tests showed that students improved significantly in their ability to use these critical thinking skills. The tape recorded discussions and the teacher's anecdotal record also showed an improvement in the use of these skills. The improvement in critical thinking varied from student to student and from skill to skill.

Creutz and Gezi (1965) conducted an experiment to determine whether critical thinking could be developed through current events discussions in ninth and tenth grade classes. The skills emphasized in this study were: evaluating assumptions and inferences, interpreting points of view, identifying cause and effect relationships, and drawing conclusions. Two world history-geography classes were chosen to comprise an experimental and control group. During a ten-week session the control group studied current events without the stress on critical thinking, while the experimental class used worksheets and exercises designed to foster the skills being studied in this experiment. Each class was given a pre-test and post-test based on the **Watson-Glaser Critical Thinking Appraisal** with the content area drawn from current events. The scores on these tests showed that the experimental group gained in these skills, whereas the control group did not show any gain. It was concluded that critical thinking skills in current events can be improved by instruction which stresses critical thinking in the classroom.

Richert (1967) studied whether the critical thinking abilities of students can be improved significantly by a physical science course that emphasized problems, assumptions, data, and hypotheses. Three college freshman physical science classes were used in this experiment. One class was a traditional physical science class using standard lectures and demonstrations. Another class was a survey course where the concern was with the application of facts and principles. These were the control groups. The experimental class was concerned with students analyzing problems, collecting and organizing data, and testing hypotheses. The American Council on Education **Test of Critical Thinking, Form G** and pencil and paper tests were used to determine gains in critical thinking. The experimental data showed a statistically significant improvement in critical thinking in the experimental group as compared to the control groups. The results of these tests support the hypothesis that critical thinking abilities can be improved in a one-semester course in physical science when one teaches specifically to develop these abilities.*

More recent research on a specific program designed to teach critical thinking, the *Philosophy for Children Program,* of the Institute for the Advancement of Philosophy for Children, has been conducted since 1970. Lipman et. al. (1980) hypothesized that children needed help to improve their reasoning and that such an improvement would in turn be reflected in the enhancement of other academic skills. A 1970 experiment demonstrated that a nine-week program could produce impressive gains not only in reasoning, but also in reading. Student reading results on the Iowa Test of Basic Skills showed statistically signficant differences. These reading gains remained highly significant two-and-a-half years later. A later study (1975) of sixth graders in the program found substantial improvements in reading, significant improvements in critical thinking involving listening, and highly significant gains in interpersonal relationships. The children in the experimental classes gained an average of eight months in reading ability against five months for the control group.

The Educational Testing Service (ETS) evaluated a two-year Lipman experiment in teaching thinking which sought improvements in reasoning, academic readiness and basic skills. ETS concluded that the overall *Philosophy for Children Program's* effect on reading and math was highly significant. In math, the experimental gain was 36 percent larger than the control, in reading the experimental gain was 66 percent larger. Additionally, the teachers viewed the program as having a very favorable effect upon student motivation and interpersonal attitudes, and as resulting in a marked improvement in children's communication skills. The *length* of the program was found to be of critical importance, suggesting that the greater the exposure, the better the students performed. The overall impact of the *Philosophy for Children Program* on the reading and math performance of the children in the ETS study, was at the highest possible level of significance (.0001), with highly significant improvement in reasoning in the majority of grade levels.

Project IMPACT (*I*mprove *M*inimal *P*roficiencies by *A*ctivating *C*ritical *T*hinking), an Orange County, California Department of Education program designed to improve ability in critical thinking, language arts and mathematics, also reports positive and significant results. From October 1981 to February 1982 over 698 students in grades 7-9 in four school districts field-tested Project IMPACT. The

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students qualified to participate in the project by failing the district's proficiency tests. Tests evaluating reading, math and critical thinking skills were administered in October 1981. Project students received a minimum of 30 lessons and were post-tested in February 1982. The experimental groups achieved significantly more than the control groups in all areas (reading: 19% to 4%, math: 16% to 3%, and critical thinking: 12% to 1%).

Not only is there evidence that instruction in thinking skills improves thinking behaviors, but additional research in this area (Worsham and Austin, 1983) suggests that a structured thinking skills program in the language arts curriculum significantly improves student performance on aptitude tests, such as the SAT (Scholastic Aptitude Test). In this study, highly significant differences (.001) were found between the scores of experimental groups who received instruction on thinking skills in their language arts program and control groups on all three SAT verbal measures: vocabulary, reading comprehension, and total score. Worsham and Austin say that their findings lend support to the inclusion of a third dimension to the correlation between aptitude and achievement: facility in the application of thinking skills.

Worsham (1983) notes that research has shown that thinking ability can be improved through instruction and practice and states that the total absence of explicit instruction in cognitive skill development from most standard school curricula seems incomprehensible. Her studies demonstrating statistically significant differences in SAT scores of low SES high school students who received training in thinking skills in their language arts programs, compared to those who did not imply that:

- additional instruction time in thinking skill development would improve verbal aptitude and achievement;
- students are able to transfer and apply thinking skills learned in the classroom to comparable test questions; and
- a thinking skills program may provide a tangible means of lessening the disparity between the SAT scores of high and low SES students.

There is some contradictory evidence with regard to thinking skills. Stallings and Kaskowitz (1973) found that the frequency of factual single-answer questions at the two lower levels of Bloom's taxonomy (knowledge and comprehension) is positively related to gain in achievement. Rosenshine (1979) states that although teachers have been urged by teacher educators to ask higher level cognitive questions, some research does not support this emphasis. He cites findings where the frequency of open-ended questions was negatively related to gains in achievement, where asking different numbers of higher level questions had no measurable effect on performance on essays or on tests containing higher level questions.

But Rosenshine also agrees that there is confusion over what is meant by higher-level cognitive questions. He states that questions coded as "higher level" in these studies may really be personal questions or opinions. The studies he cites as non-supportive of higher order emphasis do not focus on systematic comprehensive and direct emphasis on thinking skills. Terms appear vague and undefined, and include such "higher level thinking" strategies as teachers reading questions to children from scripts with predetermined questions. The bottom line in such contradictory findings may well be the fact that *test questions requiring critical thinking skills and the use of higher cognitive abilities simply do not appear on achievement tests*. Most current tests simply do not require interpretive or critical thought.

Darling-Hammand, et. al. (1983) support this assertion. They say that a problematic research finding is that the effectiveness of two very distinct sets of teaching behaviors vary depending on the goals of instruction: many of the behaviors that seem to result in increased achievement on standardized tests and factual examinations are dissimilar, indeed nearly opposite from, those that seem to increase complex cognitive learning, problem-solving ability and creativity.

Centra et. al. (1983) say further that higher order skills are not particularly likely to be acquired (and certainly will not be demonstrated) by students whose teachers ask only lower order questions. When the measure of student achievement is multiple choice, factually oriented testing, it is not possible to assess the effects of a teachers' higher order questions, and no conclusions regarding the effectiveness of teacher questioning should be drawn from such studies. Some research suggests that desirable outcomes of education—independence; curiosity; and positive attitudes toward school, teacher and self—seem to result from teacher behaviors that are different from those prescribed for increasing student achievement on standardized tests. These issues need to be studied further. This does not mean that such testing is never justified, but that we need to reexamine what such tests truly measure and, where necessary, improve them.

In a synthesis of the research on teachers' questioning, Gall (1984) found that research prior to 1970 has provided few answers for practitioners since there was conflicting evidence. However, more recent studies have found that the predominant use of higher level questions during instruction has a *positive* effect on student achievement. This research appears to support the emphasis on higher cognitive questions as generally producing better learning than emphasis on factual questions. Yet improving the quality of teacher questions is not sufficient. While skill in the art of Socratic questioning requires considerable emphasis and practice, students also need to learn the response requirements of different types of questions. Lipman (1980) and others have established that a preference for critical questioning over rote memorization—often referred to as "intellectual curiosity"—is associated with higher achievement even when achievement is measured by tests of factual knowledge. Yet so far there have been no studies that relate specific questioning strategies to the development of the critical questioning habit. Common sense tells us however that questioning will be infectious if the child identifies with a questioning person. It also follows that when questioning is rewarded, it will increase.

The research on teaching effectiveness tends to support the use of questioning and discussion as methods to increse student achievement. The findings of direct instruction/interactive teaching have highlighted patterns of instruction which are more effective in producing student gains: teacher-directed learning and high levels of teacher-student interaction. The more effective teacher places a clear focus on academic goals, structures the learning activities, actively presents the concepts, assesses student understanding and progress, and provides immediate corrective feedback to student responses (Rosenshine, 1979, Good, 1979, and Brophy, 1979). Learning occurs when students read aloud, ask questions and receive feedback, and hear others ask questions and receive responses. More effective teachers are more active and have more interaction with students. High levels of teacher-student interaction mean that during most of the day or period, students spend their time interacting with the teacher either individually or as part of a group. In addition to lecture and drill, the teacher leads discussions, solicits student responses to questions and provides feedback to students.

There is evidence from recent experimental studies in the classroom that critical thinking can be substantially improved by certain kinds of instruction and guidance woven into the regular school curriculum (Glaser, 1985). For example, Glaser conducted controlled experiments which called for defining, teaching, and evaluating the impact of specially designed instruction on certain aspects of critical thinking. This instruction was integrated into the regular English class curriculum and presented to two classes of high school students in each of two separate school systems. Students receiving instruction in critical thinking were then compared with similar classes that did not receive this special instruction. (The research involved a total of four experimental and four control classes.) Both high schools participating in the experiment had the development of critical-thinking skills as an officially stated educational objective. The most important finding from this study was that critical thinking *can be substantially improved* as an outcome of instruction designed to develop these skills within the existing curriculum.

Cornbleth (1985) describes findings in problem-solving research which have implications for teaching for thinking. This research examines experts' and novices' means of problem representation, solution and justification. Whereas experts give considerable attention to problem representation, novices only give only superficial attention and jump to conclusions about solutions with little argument development or use of knowledge specific to the situation. Expertise seems to rest on a sophisticated knowledge base of domain-specific and general knowledge, reasoning skills and problem-solving strategies: experts have procedural as well as empirical and conceptual knowledge that enables them to systematically integrate, elaborate, clarify and evaluate proposed solutions, supporting them with reason and evidence (essential critical thinking skills). So it appears that expertise is not merely information acquisition (which is how our schools currently function), but also the construction, expansion and refinement of conceptual networks that interrelate factual information, concepts, principles and procedures. We should also not forget that many of the most important questions we face cross disciplinary lines and cannot be settled by "experts" in a particular field.

The research related to critical thinking, while not definitive and specific enough to guide instructional decisions, does provide us with some proof that efforts to infuse teaching and learning with a critical thinking emphasis has some positive effects. The studies mentioned here suggest that:

- explicit instruction can improve children's ability to do certain kinds of critical thinking and reasoning;
- that critical thinking/reasoning skills and abilities can be improved through an emphasis on these skills in the subject areas (e.g., math, science, social studies);
- that young children possess the fundamental abilities required for thinking critically (The Philosophy for Children Program, for example, begins at the kindergarten level);
- that teaching for thinking appears to have a correlation with certain academic skills (writing, reading, math);
- that teaching for thinking correlates with communication skill improvement: listening abilities, verbal aptitude and interpersonal relationships;
- that the length of time for an effort infusing critical thinking into subject areas is a factor: the longer the exposure, the larger the gain; that concerted efforts to improve the thinking skills of low achievers can be successful in increasing academic achievement;
- that knowledge acquisition alone will not develop critical thinking skills, abilities and dispositions; they need to be specifically cultivated;
- that expertise consists of a sophisticated knowledge base of domain specific and general knowledge *and* critical thinking/reasoning skills and problem-solving strategies.

This section has described various definitions, descriptions and characterizations of the dispositions and skills for thinking critically. Critical thinking has been discussed in its "weak" sense (a set of discrete, vocational thinking skills), and in its "strong" sense (integrated skills intrinsic to fairmindedness). It has been defined as "fairmindedly interpreting, analyzing or evaluating information, arguments or experiences with a set of reflective attitudes, skills and abilities to guide thoughtful beliefs and actions." A brief sketch of the diverse research on this issue was given, leading to the conclusion that more research on critical thinking instruction in the K-12 setting is urgently needed.

We now turn to the essential *process* of the critical thinking movement: the teaching of critical thinking. In order for inquiry to thrive, certain conditions must be present in the educational environment, among them a genuine system-wide commitment to the concept of the school as a community of inquiry and teachers committed to the process of inquiry who are encouraged in their efforts.

CHAPTER 3: CRITICAL THINKING: TEACHING CHILDREN HOW TO THINK FOR THEMSELVES

A. Beginning the Transformation of Emphasis

> . . . Teachers who can model an endless quest for meaning, for more comprehensive answers in life's important issues, are the most important ingredient. Since thinking is an art, the teacher of any art must be able to discern the creative dispositions of the child and encourage their fulfullment . . . must be prepared to nurture and cultivate a rich profusion of thinking styles, yet all the while insist that each child's thought be as clear, consistent and comprehensive as possible so long as the content of the child's thought is not compromised . . . the proper role of the teacher is to encourage intellectual creativity as well as intellectual rigor . . . to listen scrupulously to what children actually say and are trying to say, the ability to recognize the logical pattern of children's discourse, the ability to orchestrate discussions, and the ability to encourage children to think for themselves.
>
> Lipman et. al. (1980)

There are major issues facing teachers and policy makers who live daily with the contradictions between district and school organizational arrangements on the one hand and the theories of thinking as an active holistic, inquiry process demanding the students' total involvement on the other, says Larry Cuban (1985). He recognizes that teachers and administrators are "less than captains of their fate as they are entangled in the consequences of past solutions to problems, conflicting expectations, and persistent demands." The current architecture of schooling produces classrooms where the teacher is both leader and captive. He believes that nothing short of a major, intense, politically-supported national movement to alter existing ways of operating schools will be able to transform critical thinking from ideal to reality. Until then the probability is that incremental modifications will continue to be the pattern.

All is not lost, however, concludes Cuban, as teachers do have some discretion, and within that margin of freedom many teachers invent, adapt, maneuver and create classrooms where reasoning is prized and nourished. As yet, there is a lack of a large body of research-generated knowledge on which to build an instructional technology—and much work is needed in this area. Conventional wisdom at least provides us with generally agreed upon principles as to how to proceed.

Integrating Thinking Skills Into the Curricula.

Most proponents of critical thinking, including the AFT, believe it should be a planned part of the total program, done "thoughtfully" within the framework of the existing curriculum (Raths et. al. 1967, Lipman et. al. 1980, Fraenkel 1980, Beyer 1983, Paul 1984, among others). "If what we want ultimately are thoughtful, inquisitive, imaginative, reasonable children," says Lipman, "then thinking skills must be integrated into virtually every aspect of the elementary educational process." The integration of thinking skills into every aspect of the curriculum, he contends, sharpens children's capacity to make connections and draw distinctions, to define and classify, to assess factual information objectively and critically, to deal reflectively with the relationships between facts and values, and to differentiate their beliefs and what is true from their understanding of what is logically possible. AFT President Albert Shanker concurs: "I believe it is extremely important that critical thinking not be viewed as purely a formal skill, just as reading at the eighth grade level doesn't enable you to necessarily read anything. I believe very strongly that critical thinking has to take place in social studies and has to take place in mathematics, in all the disciplines. It has to be an integral part of the curriculum not something separate from it. The AFT is making the infusion of critical thinking in the basic curriculum one of its top priorities."

Such an education structured for thoughtfulness, promises to be an academically superior education in behaviorally measurable terms and as an instrument for life experience. Research on Lipman's critical thinking program indicates that children who have been encouraged to be systematically inquisitive and reflective naturally tend to import such behavior into the remainder of their learning activities. Thus, the classroom as a "community of inquiry"—committed to the procedures of inquiry, to responsible search techniques that presuppose an openness to evidence and reason—will foster learning and thinking habits for meaningful lifelong learning.

Scriven (1985) has noted that the very concept of curriculum is in trouble. This is due to the fact that critical thinking skills are not commonly recognized as a necessary part of the basic curriculum, whereas they are in fact the glue that connects knowledge of facts with any application of that knowledge. He stresses the need for enormously improved analytical capability with respect to contemporary problems:

> "My sense is that is we spent half the time on analysis of contemporary problems that we do on national history in the schools, we would double the chances of there *being* a national history this time next century . . . Contrary to the popular diagnosis of how small a part reason plays in human life . . . on the limits of human capacity to be rational, I take the

much simpler view that this just shows how little skill in reasoning we teach. Reasoning *takes* teaching, and reasoning about practical problems takes teaching reasoning using tough, practical, controversial problems as examples . . . we have set our primary and secondary schools up so that with few exceptions it is professionally impossible to survive as a teacher or administrator if you insist on the explicit use of tough, practical, controversial examples. That must be changed if we are to survive."

Bereiter (1984), in writing on how to keep thinking skills from going the way of all frills, identifies two approaches to teaching thinking skills that usually do *not* succeed: treating thinking skills as enrichment and treating thinking skills as separate subject matter. Instead, the promotion of thinking skills should be deeply embedded in the "whole fabric of an instructional program." The main ways to guard against failure are to make thinking skill activities an integral part of other, already accepted instructional objectives, and to permeate the instructional program so thoroughly with thinking skills that they can not be isolated and reduced to verbalized subject matter. The strength of integrating these skills is that the existing curriculum and texts can be used. The *process* of teaching changes, not necessarily the content, although concerted efforts are being made by the ASCD Collaborative of 20 national educational organizations to influence publishers of textbooks and instructional materials to more effectively infuse thinking skills into their materials.

Exposure to subject matter alone will not improve critical thinking ability. The content alone of any subject is not likely to develop a generalized ability to reason logically and productively, says Glaser. He notes that:

> A student does not tend "naturally" to develop a general disposition to consider thoughtfully the subjects and problems that come within the range of his or her experience: nor is he or she likely to acquire knowledge of the methods of logical inquiry and reasoning and skill in applying these methods, simply as a result of having studied this subject or that. There is little evidence that students acquire skill in critical thinking as a necessary by-product of the study of any given subject. On the other hand, almost any subject can be taught in a manner designed to put students on guard against hasty generalization, contradictory assertions, uncritical acceptance of authority, and common logical fallacies in reasoning. Thus, transfer of training from the study of logical reasoning and methods of evaluating the adequacy of evidence in a subject-matter field such as geometry or general science *can be brought about*, but it does not occur automatically.*

These skills do *not* develop automatically. Studies using the New Jersey Test of Reasoning with college freshmen and elementary school children found that the mean scores of the college students were less than one point above the mean scores of sixth graders, suggesting that the basic repertoire of reasoning skills of the adult is relatively unchanged from that of the sixth grade child. A major national reading and literature assessment of over 100,000 U.S. school children found that although students at each age level had little difficulty making judgments about what they read, most lacked the problem solving and critical thinking skills to explain and defend their judgments. This was found *not* to be a cognitive inability of students to respond analytically, but a result of current emphasis in testing and instruction solely on multiple choice and short answer responses where students are simply *unused* to doing tasks requiring critical thinking.

In their development of a critical thinking program, Falkof and Moss (1984) found that most students are unaware of their thinking processes, but that even from very early ages, can think about their thinking. For example, as early as kindergarten, children can understand and use the word "infer" provided they have experiences that teach and reinforce the concept. They believe that we often do not given children enough credit for their inate reasoning ability.

Piaget has noted that the child is an active, construing creature, inherently predisposed to thinking activities. There is a developmental sequence in the growth of thought from the concrete to the abstract and the basic skills are the foundation for the higher level abilities. Instructional strategies purposefully designed to develop, foster and enhance critical thinking with respect to the students' developmental levels must be carefully integrated throughout the elementary and secondary curricula. Cornbleth warns, however, that there is a myth that critical thinking is wholly dependent on stages of cognitive development and that this myth negatively affects expectations about students' ability or disposition to engage in critical thinking. There are questions about the consistency of developmental stages across tasks and subject areas; however, task-relevant knowledge rather than developmental stage may better explain identified age differences in students' reasoning.

Support for Teachers.

At the system level, teachers have to be involved in shaping the discussion on critical thinking. The evidence shows that the importance of critical thinking is being recognized and that the necessary reexamination is beginning. The massive efforts in California to rewrite student assessment tests is a good example, since California has led the way on many recent reforms. Critical thinking committees with teacher representation are meeting throughout the state to develop goals and objectives and to set the course for the massive reforms to be implemented in textbooks, curriculum, staff development and teacher education.

Teacher involvement is imperative in such initiatives, if the professionals ultimately responsible for implementing the concept are to have any identification, ownership or acceptance of it. Teachers can highlight potential implementation obstacles and make suggestions for redefining practice in this area. They can articulate the constraints of current test emphases and current curricular mandates and requirements, and define the support systems necessary to ensure the success of this transformation of emphasis. Much care, time and planning is necessary to keep the critical thinking movement from going the way of educational fadism.

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The development of classrooms where inquiry and critical thinking are valued requires much more than individual teachers being committed to the quest for the "critical spirit." Such development requires school-wide and system-wide commitment and rational thinking. This involves not only valuing teachers and students as critical thinkers, but calls for concerted efforts to create climates conducive to these efforts: long term and meaningful staff development activities to encourage critical thinking rather than traditionl one-shot inservice programs which superficially address issues; access to resources and materials to enhance and expand critical thinking instruction within the curriculum and across disciplines, rather than gimmicky pre-packaged panaceas; time for teachers to meet, interact and model effective strategies and explore new ways to enhance their professional skills in this area rather than increased demands with no time to effectively "think" about them. In other words, school systems need not only to profess commitment to critical thinking as an educational goal, but need also to back up such commitment with the necessary resources for teachers and students to make achieving this goal a true possibility.

B. The Paideia Approach as a Framework for Thinking About Critical Thinking

The Paideia Proposal provides a framework for conceptualizing and fostering the critical thinking process. This section will describe the Proposal as it relates to critical thinking. It is premised on the idea that all three kinds of teaching and learning (didactic, coaching and discussion) are equally valuable and should be thoroughly intergrated with each other. The *kinds* of knowledge to be acquired are learned by didactic teaching (lectures and textbook assignments). The intellectual *skills* to be developed are learned by coaching. The *understanding or insights* to be gained from the knowledge occur by Socratic teaching (questioning and discussing). This section summarizes these three types of teaching and learning.*

The proposal's authors also believe that the three kinds of teaching and learning should run concurrently through all 12 grades. Knowledge to be acquired through didactic instruction *must* be made secure by the skills to be developed by coaching, and understanding through discussion and guided practic. Radical and fundamental changes will be required to make this ideal a reality in today's schools.

The basic precept of Paideia is that "all genuine learning arises from the activity of the learner's own mind." Learning may be assisted, guided and stimulated by the activity of the teachers, but when teacher activity renders students passive, they cease to be learners. The teacher's activity in telling students what they should know may result in their *remembering* information, but it does not result in *genuine* knowledge unless what is to be known is "actively grasped by the mind rather than passively retained by the memory." To grasp it requires some critical assessment.

Didactic Teaching.

An important point is that students need to be active in didactic instruction also: they must think as they listen. To elicit active listening, students must expect questioning by the teacher in the same class period as the lecture and in later periods. Not more than one-half of the class time should be devoted to "telling." The other half should be devoted to "asking."

The question and answer period should always be two-way talk and should involve questions asked by students and teacher. Classroom talk should begin by telling listeners *what* they can expect to learn and *why* they should pay attention to it. On the whole, the rule of thumb should be "less is more." Didactic lessons should not aim to cover a certain amount of material regardless of whether the students truly "understand" it, but instead should cover as much material as the students are able to absorb. Written material, also, should always be accompanied by questions because in no other way can students fully understand what they have read.

Coaching.

Coaching forms the habits through which all skills are possessed. Theodore Sizer illustrates the technique in the following example:

> A ninth grader algebra class. Carl writes on the chalk board.
>
> $2x + 6 = 8$
> $2x = 2$
> $x = 0$
>
> Carl's teacher: **Carl, check it for me.**
>
> $2(0) + 6 = 8$
> $0 + 6 = 8$
> $6 = 8$
>
> Carl: (pause) It doesn't work.
>
> **Write out your steps.**
>
> $2x + 6 = 8$
> $(2x + 6) - 6 = (8) - 6$
> $\frac{2x}{2} = \frac{2}{2}$
> $x = 0$
>
> **When you divide 2 by itself, do you get zero?**
>
> Umm.
>
> **Write it out.**
>
> $2\overline{)2}$ with quotient 1
>
> **So . . .**
>
> One.
>
> **Right! Now go back to your problem.**
>
> $2x + 6 = 8$
> $(2x + 6) - 6 = (8) - 6$
> $2x = 2$
> $x = 1$
>
> **So far so good. Now give it another check.**
>
> $2(1) + 6 = 8$
> $2 + 6 = 8$
> $8 = 8$
>
> It works.

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Why does it work?

I subtracted 6 from each side of the equation.

Yes . . . and you divided 2 by itself properly . . . Now, could you solve this equation another way?

Umm.

Try.

(A long pause. Doodling on the chalk board.)

Remember, as long as one treats each side of the equation similarly, one can perform unlimited operations . . . you tried subtraction, and it helped you to solve the problem. Could some other operation work equally well?

(A pause. Scribbling.) Take 2 out.

What's that mean?

You know, take it out.

You mean, subtract 2 from each side?

No, divide by 2.

Write it out . . . now, let's see your work.

$$2x + 6 = 8$$
$$2(x + 3) = 2(4)$$
$$\frac{2(x + 3)}{2} = \frac{2(4)}{2}$$
$$x + 6 = 4$$
$$x = 1$$

So . . . it works. But it didn't work for Eddie here. Look at Eddie's problem and tell him why.

(Eddie's solution, adjacent on the chalkboard.)

$$2x + 6 = 8$$
$$\frac{2x + 6}{2} = \frac{8}{2}$$
$$x + 6 = 4$$
$$x = 4 - 6$$
$$x = -2$$

Umm . . . it *should* work.

But it doesn't, and yours did. Why?

You see . . . the 6. It should be three.

Ok . . . now, here's another one: $10 + 2x = 30$ . . . Eddie, show Carl how to do it.
(p. 32-34)

In this coaching example, Sizer demonstrates that the student is learning algebra, but he is also learning about "observing, calculating and about how to trouble-shoot, how to identify errors and figure out what caused them. He is learning, fundamentally, how to think—logically, resourcefully and imaginatively." These skills can be learned only through trial and error. In coaching, the student is the key worker and the subject matter is the "stuff" with which he is developing his skills.

To effectively coach, 1) the teacher must know the student, 2) the material of coaching must be the students' work, 3) immediacy is crucial (teachers *must* have time to correct student work thoroughly and promptly), and 4) shrewd criticism is essential. Coaching requires time and a class size small enough so that a teacher can learn how each pupil's mind works. In essence, coaching helps students mold their thinking skills and habits of inquiry.

Socratic Teaching.

Socratic teaching develops the understanding or insights from the knowledge acquired. It moves the learner from "knowledge to knowing." The questioning of students helps them improve their understanding. The primary goal is to bring out and clarify issues raised in what they've studied. We don't learn "knowledge" in a vacuum, but in the context of other knowledge and understandings. New knowledge is integrated with past learnings forming an ever increasing storehouse of knowledge. Often questions used in the Socratic method are "the questions to which there are no 'right' answers." It is a mode of questioning to lead more deeply into the meaning, order or justification of knowledge.

The Paideia group asserts that Socratic teaching should start in kindergarten and continue throughout schooling, and that it is simply wrong to think that young children are incapable of considering and talking about ideas and issues. Discussions should be joint searches, the best of which result in "something new and unexpected being discovered." The teacher needs to:

- ask a series of questions that define the discussion and give it direction;
- examine or query the answers by trying to draw out the reasons for them or the implications they have;
- engage the students in two-way talk when views appear to be in conflict.

The teacher needs to be as exact in listening as in questioning. The state of mind of students and teachers is an important element in effective teaching: those engaged in a discussion should be open-minded, prepared to change their minds as a result of what happens, and willing to consider new opinions. Such discussions improve and enhance the learning that didactic teaching is concerned with by making the learners' minds more active and more involved with the knowledge. The Paideia Proposal offers a framework for integrating the three types of teaching and learning.

C. Essential Elements of Critical Thinking Instruction

There are classroom essentials involved in a commitment to truth and inquiry, a commitment to nurturing the development of critical thinking abilities in students. There are essentials for teaching children how to value the authority their own reasoning, for encouraging "self-formed, self-reasoned conviction." These essentials include the classroom climate, discussion and questioning strategies, and the design of lessons and activities.

Classroom Climate: Nurturing the Critical Thinking Dispositions

Helping children believe in themselves has been said to be one of the most valuable gifts we can give them. The search for significance and a sense of belonging are basic needs of all human beings. The school has a significant ef-

fect on the need to belong, to feel worthwhile, since a child's identity is so deeply associated with success in school and image in the peer group. The significance of an encouraging environment is crucial to critical thinking and the development of confidence in one's reasoning. The loss of confidence in one's self and one's ability leads to *discouragement*, or the absence of courage. Children internalize the expectations of the significant adults in their lives. If we communicate to them that we believe in them, they will begin to believe in themselves. If we hope to enable children to value the authority of their own thinking, encouragement is vital to helping them gain confidence in their own reasoning.

Trust and mutual respect go hand in hand in an encouraging environment. A classroom that frees children to express themselves is grounded in the notion that children are equal to adults in terms of human worth and dignity. If we want children to see themselves as worthwhile persons, we have to let them know we accept them as they are, while at the same time creating an environment in which they feel free to risk being themselves, to make mistakes and learn from them, and to grow and to become independent thinkers. Mutual respect also involves the ability to be a good listener.

Critical thinking dispositions and attitudes need to be encouraged, modeled and reinforced in every aspect of classroom life. A classroom environment which promotes curiosity, objectivity, flexibility, informed skepticism, persistence and respect will produce students excited about learning, students who fee free to take risks with their thoughts, students who approach ideas imaginatively, and students who value and respect the contributions of others. These students will be less rigid, less dogmatic, less biased and less afraid of exploring their own potential.

The affective domain is as important as the cognitive domain in thinking critically. Students need to integrate these dispositions and attitudes into their "world views" as as much as they need to know what the "tools" of critical thinking are. Without empathy, open-mindedness and intellectual honesty, the most skilled rational thinker cannot make informed decisions, but merely uses these tools to support prejudicial positions.

How can we "teach" the dispositions—critical thinking in the "strong" sense? In addition to modeling them, having certain ground rules for discussion and activities are useful. For example, when using brainstorming to generate alternate solutions to a problem, a general rule is that there is no criticism of ideas until the stage for evaluating them. All contributions are respected with even the most far-out ideas considered of value in generating even more ideas or another approach to the problem. This respectfulness of the contributions of others can be applied across all classroom activities. Another classroom "rule" might be that the teacher will accept student answers or positions *if* they are supported by defensible reasons. Lockwood and Harris (1985) say that it is important for students, at times when appropriate, to understand that they are not going to be graded for a particular position they take but on the depth of thought they show in supporting their statements. The teacher may grade using some or all of the following criteria: the clarity of expression, relevance, consistency and accuracy of logic or responsiveness to opposing points of view. In discussions, the teacher may want to develop a checklist of desirable and undesirable types of discussion behavior and these criteria might include: sticking to the questions at issue, responding to the arguments expressed by others, and supporting one's views with reasons and evidence.

The teacher's own risk-taking ability is at issue here. Under the one-right-answer model, the teacher and the textbook are perceived as the ultimate authorities. How comfortable teachers feel with students questioning things in the classroom is an important factor. Many teachers welcome the lifting of the burden of "knowing all" the answers—being the ultimate expert. Not all answers are known, and no one can be an expert on all things. Being able to admit that you don't know the answer to a particular question but would be happy to help the student find it, is difficult but necessary and realistic. This teaches the student that mistakes are a part of being human and are opportunities for learning.

The teacher who is able to admit making a mistake also teaches students a valuable lesson: that mistakes aren't sins, that anyone can make one, and that we can learn a lot from our mistakes. The teacher does not give up authority in a classroom designed for thinking, but increases her authority when, through respect of student ideas and questions, she helps make learning more meaningful for them.

Discussion and Questioning Strategies

> From dialogue we learn ways in which people draw inferences, identify assumptions, challenge one another for reasons and engage in critical intellectual interactions with one another . . . critical attitudes toward what other people say are developed in the participants of a discussion. These critical attitudes are turned upon one's own reflections. One considers carefully what others might say about one's contribution, once one has learned the techniques of critical examination of others' thinking processes and modes of expression . . . thinking is the internalization of dialogue . . . the role of classroom discussion in motivating children to engage in academic activities has often been underestimated. (Lipman, et. al.)

This description does not mean just any type of classroom discussion. It calls for a careful nurturing of critical habits of thought, of giving children the tools by which they can assess the information that comes to them—tools to help them discover they can think about their thinking in an organized way. This includes the development of a systematic presentation of ideas, the ability to examine one's own thinking and the thinking of others (moving back and forth between opposing viewpoints), and developing conclusions and convictions based on reason and evidence.

The questioning techniques of the teachers *and* the students are the basic factors. Fraenkel (1980) believes that the essence of effective teaching strategies is in the questions that the teacher asks. He cites the need for a variety of interesting, carefully thought out, well-designed learn-

ing activities to involve or engage students in subject matter. The development of good questions which promote inquiry is no easy task, but a skill that requires a level of sophistication not only with the subject matter but with the essentials of critical thinking so the teacher knows the kinds of questions to ask and how to formulate them effectively. Fraenkel also focuses on *student* questioning, emphasizing that the ability to ask significant questions is an important skill for students as well as teachers.

Frances Hunkins (1985) has devised strategies for helping students ask their own questions. One strategy is identifying an issue or topic in material the students are studying, and having *them* plan the investigation using a questioning cycle: the planning phase, the implementing phase and the evaluating phase. For example, he raises the issue of investigating the Canadian culture and testing the hypothesis of some experts that despite its apparent unity, Canada is actually struggling to attain a cohesive and recognizable identity.

The students then brainstorm possible guiding questions for testing this hypothesis. Together or in small groups they identify the most important questions and are directed to assess the reasoning embedded in their sequencing of questions. Here is a sample of questions that students came up with for the planning phase of their investigation:

- What is the current makeup of the Canadian population?
- What is the current government?
- What are the sources of the view that Canada has problems attaining a national unity?
- Specifically what is being said?
- Are these sources qualified to make such statements?
- What are the bases for these statements?
- Are these statements examples of bias?
- Do these examples really support the argument?

When formulating the right questions is as important as formulating the right answers, thinking critically about subject matter is enhanced. Students continue to develop confidence in their own thinking. With continuing practice and application of these skills to the students' own lives, they will be more likely to know the right questions to ask on the important issues of their lives.

Teachers also need to give students sufficient time to think before responding to questions. Research findings indicate that most teachers wait only one second before repeating a question or calling on another student. By extending "wait time" for several seconds, teachers achieve improve student engagement and verbal responses: the amount and quality of the discussion increases and there is more talk at a more elevated cognitive level. Students tend to respond with whole sentences and complete thoughts. There is an increase in their creativity, in their speculativeness and in the number of questions they ask (Rowe, 1974). Good and Brophy (1973) found that extending wait time serves other purposes. By waiting for an answer, teachers demonstrate not only that they expect an answer, but also that they have faith in the students' ability to answer given enough time.

Research has shown also that active learning has a positive effect on student's development of decision-making skills and their attitudes toward school, teachers, content to be learned, and learning itself (Kahn and Weiss, 1973). Others have found that students learn more in a question and discussion strategy (Gage, 1976). Greater gains were found for 5th grade reading when teachers spent time discussing, explaining, and asking higher level questions and stimulating cognitive processes.

In *Developing Minds*, the ASCD resource book on student thinking (1985), editor Art Costa also cites research on the effectiveness of asking questions for students to clarify their thoughts. He notes that Flanders (1960) found achievement higher in classrooms where teachers use, build on extend or clarify students' ideas; Kleven (1968) found that when teachers use clarification, students tend to increase their consistency in thinking and become more purposeful in their thinking; and, finally, Rosenshine and Furst (1976) found that when a teacher responds to students' comments by encouraging them to elaborate, there is a significant and positive correlation with student achievement.

Costa notes that clarification contributes to the development of students' abilities to think about their thinking (metacognition) and says that there is much evidence to suggest that causing students to talk about their thinking processes and problem-solving strategies (having them explain their answers and how they arrived at them or share the rationale behind them) before, during and after, enhances their ability to think.

Yet, Falkof and Moss (1984) find that 80-85 percent of all questions asked by teachers are on a factual level and that the questions posed determine the level of thinking and the quality of the responses. Good teacher modeling is the first step in helping children create good questions themselves. Brooks (1984) notes that it is no secret that the vast majority of questions asked in a classroom have only one correct answer which the teacher already knows. Most students, he says, being both intelligent and sensitive to their environments, understand these dynamics and often decide not to waste time pondering questions, but to quickly determine the answers valued by the teacher. These dynamics, unfortunately, serve not only to stifle thinking, but to thwart risk-taking.

In addition to a sound knowledge base in their own fields, teachers need to be able to think critically within their disciplines. Teachers need to know the essential elements of critical thinking and when the situation/activity/discussion calls for a comment or question encouraging critical thought, how to structure an activity or assignment to promote the application of these skills to the subject matter, how to design assessment instruments to observe and measure a student's extended thought. An over-emphasis on the "right answer" doesn't necessarily emphasize learning or thinking things through, but an ability to memorize the "right answers."

Problem-solving theory based on research examining experts' and novices' ability to represent problems and identify solutions (with justification) supports the notion that more than information is necessary to effectively solve problems—a dimension of critical thinking. Experts give considerable attention to problem representation. They rely on a sophisticated knowledge base, on reasoning skills and on problem-solving strategies. They systematically ask themselves questions that integrate, elaborate, clarify and evaluate proposed solutions, supporting them with reason and evidence. (Cornbleth, 1985).

Learning depends on how meaningful the material is and on the student's understanding of the material and the fit of the material into the student's existing knowledge base. The teacher's role is to assist students to express and extend their own ideas and to clarify those ideas until the purposes of learning have become clear for them. Facts, concepts, relationships, principles are learned more effectively, more meaningfully if the student plays an active role in discovering their relationships than if they are merely told. When learners play an active role in processing and reorganizing the information to be learned, the highest level of learning occurs.

Effective use of discussion and questioning strategies help students make those connections, discover those important relationships between ideas and concepts. Questions that get students to seek evidence, to ask questions, to examine their own reasoning, to explore alternatives, to evaluate consequences are questions that develop and enhance critical thinking.

We can begin encouraging critical thinking by having children actively involved in exploration that will lead them to see the connection between their lives and their learning. We begin by encouraging students to search out underlying assumptions, guiding reasons, possible implications and alternative criteria. This approach focuses not merely on learning historical or scientific facts, but on emphasizing life's connections so that children can come to think historically or scientifically.

Keeping in mind the limitations of questioning hierarcies which will be discussed in the next section (that they should *not* be prescriptions for questioning strategies, that one category is not superior to another, that learning is not linear in an orderly progression from level to level), they can be useful in enhancing a teacher's questioning repertoire. Approaching lessons in the context of these critical thinking skills allows emphasis on these skills to become automatic and gives students an opportunity for consistent practice. The appendix examples illustrate various types of questions in different subject matter areas, at both the elementary and high school levels. They are presented solely to illustrate the application of a range of skills to different subject matter and grade levels. These sample questions go *beyond* simply recalling information. (See appendix).

Kownslar (1985) has developed 10 generic key questions to engage students in critical thinking skills. He believes that once students gain experience in using these generic questions, they can continue to use them for any topic. They are:

1. What were the *main point(s)* stressed within each source?
2. How would you define *value claim?* Did the source use any?
3. What is the main difference between *relevant and irrelevant information,* claims or reasons? How would you classify the source accordingly?
4. What is *bias*? Do you detect bias in the source? Explain.
5. What is an *unstated assumption*? Are there any in the source? Explain your reasons by indicating possible counter points to the arguments.
6. Define the words *ambiguous and equivocal*. Did the source contain any ambiguous or equivocal claims or arguments? Explain.
7. What is a *logical inconsistency* or *logical fallacy*? Are there any such lines of reasons in the source? Explain.
8. What is the main difference between a *warranted and unwarranted claim*? Does the source have either? Explain.
9. How would you go about determining *the strength of claims* made? Why? What possible counterpoints came into play?
10. *What would you now decide* about the issue raised? Why? Is your decision a hypothesis or *conclusion*? Why? Evidence for your findings?*

Lockwood and Harris (1985) maintain that properly led discussion of various issues can help students advance the quality of their reasoning. Fair and open discussion permits the natural development of mature thought and students' thinking becomes less self-centered, less conforming. Students who have an opportunity to regularly engage in such discussions are likely to develop more ethical reasoning than those who do not. They claim that these students are: 1) better able to express coherent and justified points of view about responsible action, 2) develop more complex and systematic reasoning, 3) gain deeper understanding of issues, 4) increase their ability to express clearly reasoned judgments, and 5) become more effective participants in productive discussions.

Lockwood and Harris maintain that while discussion—the crucible of public debate—tests the clarity of one's thinking, discussion skills require practice. They say that a common roadblock to classroom discussion is a belief by the teacher that students have already mastered discussion skills. Instead these skills need to be an explicit goal of instruction.

Characteristics of productive discussions include:

- student interaction: students actively listening to each other and responding to each others ideas; the teacher can promote student-to-student dialogue by challenging their reasoning, by asking for paraphrasing or for a response to another's position;
- questioning: students should be urged to pose questions to each other and to the teacher, with timing allowing for students to prepare thoughtful responses;

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- concluding effectively: time is needed to review the course of the discussion, address the points of disagreement and the reasoning underlying them, finding out what the students learned that was new, and drawing conclusions.

The skillful teacher anticipates student responses to the opening question and prepares follow-up questions to broaden students' thinking about the issue by stimulating them to reflect on their initial responses. Five types of follow-up questions, each type addressing a particular critical thinking skill, include:

- clarifying terms: asking for a definition of a term used by a student to clarify meaning;
- examining consistency: asking students to reconsider an apparent contradiction in what was said or to apply a position expressed to a similar situation;
- seeking relevance: asking the student to relate a concept, the relevance of which is not apparent to the issue being discussed;
- raising a competing issue or value: asking the student to consider an aspect or value not recognized in their initial comments;
- role taking: asking the student to assume the point of view of either a different character in a story or of a hypothetical figure. (Lockwood and Harris, 1985).*

What we ultimately should be seeking as teachers is the sophistication of thinking critically within our disciplines *so that when the situation warrants it*, we know what questions to ask, in what direction to lead the discussion, what tasks to assign which to foster thinking critically about the subject or issue.

Students who use questions learn more subject matter than students who do not. Questions help students comprehend content and give teachers immediate feedback about student comprehension and learning. It is said that when questions are given after a reading and require the students to construct answers rather than choose from multiple choice answers, the benefits tend to be stronger. Questions which are interspersed in reading passages and which require students to *apply* what they have read lead to superior results. The application forces readers to process the content more deeply, increasing their ability to comprehend and remember it.

The teacher therefore needs to become facile with the following questioning skills:

- asking questions in a logical format that is part of an overall plan;
- dealing creatively with insufficient answers, no answers, or incorrect answers;
- encouraging student responses;
- helping students generate questions.

"Your teaching goal should be to get each student to ask questions, questions, questions," says Anita Harnadek, author of critical thinking textbooks. In her teacher's guide, she makes the following suggestions for discussions fostering critical thinking:

- Do give "open book" tests and quizzes—if you're really testing students on their abilities to think critically, then the answers won't be in the textbook or their notes.
- Do have students give their own answers but they have to back them up—if their reasons can't be refuted, then why shouldn't their answers be accepted?
- Don't assume that students who are fast or slow at other subjects will be fast or slow in thinking critically.
- Don't assume that all of the students who give a certain answer will have the same reason for giving that answer—question them to bring out their reasons.
- Don't hedge about admitting that you're wrong when you're wrong—and tell your students when their good arguments have made you change your mind. By modeling such open-mindedness you are teaching them another valuable lesson.
- Don't assume that some things are too obvious to be discussed—what may be obvious to you and some of your students, may not be obvious to all.
- Don't let the class be one-sided in a discussion—take an opposing viewpoint even if you agree with the class: there can be no critical thinking when only one side of an issue is presented.
- Take advantage of the fact that every highly controversial issue has good points on at least two sides (otherwise it wouldn't *be* highly controversial) and encourage your students to discover all the good points for each side and then figure out why the opponents of that side disagree.
- Don't allow students to be discourteous to each other—an unkind statement should be backed up or apologized for. Students need to learn to disagree without being unkind to dissenters.
- Do pay close attention to everything that's being said, including comments muttered by students not participating in the discussion—subtle points which might be lost if the teacher was not listening carefully should be acknowledged and explored.
- Don't be either stingy or falsely lavish with compliments on good reasoning and don't point out every flaw in your student's thinking.
- Don't think that you have to know all the answers—that is not an admission of stupidity. Critical thinking cannot flourish when someone thinks he knows everything or thinks he has to act like it.

The Relationship of Bloom's Taxonomy to Critical Thinking.

What is the relationship between critical thinking and Bloom's taxonomy, a conceptualization of thinking that comes to mind for most teachers? Many programs on student thinking currently being developed are based on this taxonomy. What is it? How is it useful in critical thinking

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curriculum development? And what are its limitations? This section will summarize the taxonomy and describe its usefulness in enhancing one's questioning repertoire.

To begin with, the taxonomy is a ground-breaking work filled with insights into cognitive processes and their interrelations. The taxonomy arranges the cognitive processes essential to higher order thinking into a hierarchy of skills. Each classification builds on the skills and abilities lower in the scheme. The taxonomy is presented and described as a one-way hierarchy of learning, which lessens its usefulness because in reality, learning is not hierarchical in the sense implied (more on this later.) Table I illustrates the elements of Bloom's hierarchy. The table and the summary that follows are summarized from the *Taxonomy of Educational Objectives: Cognitive Domain* by Benjamin Bloom, et. al. (1956).*

Knowledge.

The "knowledge" category includes those behaviors and test situations which emphasize remembering of ideas, material or phenomena either by recognition or recall. It goes from the specific and relatively concrete types of behavior to the more complex and abstract. Knowledge of specifics refers to types of information or knowledge which can be isolated and remembered separately, while the knowledge of universals and abstractions emphasizes the interrelations and patterns in which information can be organized and structured.

Comprehension.

This category includes the largest general class of intellectual abilities and skills emphasized in schools and colleges. Bloom's definition of comprehension is broader than the frequently associated reading comprehension. The use of the term includes those objectives, behaviors or responses which represent an understanding of the literal message contained in any verbal or written communication.

Application.

Application goes a step beyond comprehension where a student will apply the appropriate abstraction to a new situation. Application involves the use of abstractions (in the form of general ideas; rules; generalized methods or principles, ideas, and theories) which must be remembered and applied.

***Example:** The ability to predict the effects of a dramatic change of climate on the Florida orange groves.

Analysis.

Analysis emphasizes breaking down material into its parts and detecting the relationship of the parts and the way they are organized. It can be used as an end (in determining the structure or organization of a communication) or as an aid to fuller comprehension or evaluation of material. It includes such skills as hypothesizing, drawing conclusions, generalizing, distinguishing.

***Example:** The following statements are either facts or hypotheses. Read each one and identify each.

Synthesis.

Synthesis is the putting together of elements and parts to form a whole—combining them in such a way as to develop a pattern or structure not there before. This involves recombining parts with new material into a new "more or less well-integrated" whole. This is the category that provides for creative behavior, though the student must work within the limits set by particular problems, materials or framework. Whereas comprehension, analysis, and application involve studying a whole to understand it better, synthesis requires drawing upon ele-

Table I

1.00 Knowledge

- 1.10 knowledge of specifics
- 1.11 knowledge of terminology
- 1.12 knowledge of specific facts
- 1.20 knowledge of ways and means of dealing with specifics
- 1.21 knowledge of conventions
- 1.22 knowledge of trends and sequences
- 1.23 knowledge of classifications and categories
- 1.24 knowledge of criteria
- 1.25 knowledge of methodology
- 1.30 knowledge of the universals and abstractions in a field
- 1.31 knowledge of principles and generalizations
- 1.32 knowledge of theories and structures

2.00 Comprehension

- 2.10 translation
- 2.20 interpretation
- 2.30 extrapolation

3.00 Application

4.00 Analysis

- 4.10 analysis of elements
- 4.20 analysis of relationships
- 4.30 analysis of organizational principles

5.00 Synthesis

- 5.10 production of a unique communication
- 5.20 production of a plan or proposed set of operations
- 5.30 derivation of a set of abstract relations

6.00 Evaluation

- 6.10 judgments in terms of internal criteria
- 6.20 judgments in terms of external criteria

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ments from many sources and putting these together in a new structure.

***Example:** If you surveyed all the grades in our school and they all felt happy about the new rules on the new playground, what does that tell you about the rules? (Elementary) Since the elections for student council were so polarized, what does that tell you about the general class sentiment? (Secondary)

Evaluation.

Evaluation involves making judgments about value for some purpose. This involves the use of criteria and standards for appraising the extent to which criteria are met. This skill encompasses all the other skills in the hierarchy. Judgments may either be quantitative or qualitative, and criteria can be set for a student or determined by the student. Judgment involves taking into consideration a great variety of facets of the phenomena to be evaluated, with clear criteria and frames of reference. It is different from quick, impulsive decisions that are mere opinion. Judgments can be made on the basis of internal evidence (logical accuracy, consistency, etc.) or external criteria (techniques, rules or standards by which such works are usually judged).

***Example:** Please indicate whether the following animals are mammals (Elementary). Using the following characteristics of a profession, determine whether teaching qualifies. (Secondary)

The taxonomy, though not designed to further critical thinking instruction as such, contains a wealth of information for use in such instruction. Most of the cognitive processes characterized as essential to "higher order" questions in fact presuppose the use of the basic concepts of critical thinking: assumption, fact, concept, value, conclusion, premise, evidence, relevant, irrelevant, consistent, inconsistent, implication, fallacy, argument, inference, point of view, bias, prejudice, authority, hypothesis, and so on. This is clear, for example, in the explanation of analysis:

> Skill in analysis may be found as an objective of any field of study. It is frequently expressed as one of their important objectives by teachers of science, social studies, philosophy, and the arts. They wish, for example, to develop in students the ability to distinguish fact from hypothesis in a communication, to identify conclusions and supporting statements, to distinguish relevant from extraneous material, to note how one idea relates to another, to see what unstated assumptions are involved in what is said, to distinguish dominant from subordinate ideas or themes in poetry or music, to find evidence of the author's techniques and purposes, etc.

In other words, if the ability to analyze typically requires students to do such things as distinguish facts from hypotheses, conclusions from evidence, relevant from irrelevant material, to note how one idea (concept) relates to another, to probe and detect unstated assumptions, then it seems essential that students become not only familiar with these words (by teachers introducing them frequently into classroom discussion) but also comfortable with using them as they think their way through "analytic" problems or write out an analysis on paper. Students (and experts) who do the best analyses, syntheses, and evaluations tend to do them mindfully with a clear sense of their component elements. So, if the concepts of critical thinking are presupposed in mindful analysis, synthesis, and evaluation, we can best heighten that mindfulness by raising those component concepts to a conscious level.

Similarly, in the Taxonomy of Objectives in the Affective Domain, many of the examples of higher-order valuing are illustrations of values intrinsic to a critical thinking model of education. The student:

1) deliberately examines a variety of viewpoints on controversial issues with a view to forming opinions about them,
2) [develops] faith in the power of reason and in methods of experimental discussion,
3) weighs alternative social policies and practices against the standards of the public welfare rather than the advantage of specialized and narrow interest groups,
4) [achieves] readiness to revise judgments and to change behavior in the light of evidence,
5) judges problems and issues in terms of situations, issues, purposes, and consequences involved rather than in terms of fixed, dogmatic precepts or wishful thinking, [and]
6) develops a consistent philosophy of life.

Along with the usefulness of Bloom's cognitive and affective taxonomies, it is important to be aware of the limitations for critical thinking curriculum construction. The category of "knowledge" is analyzed in a restricted way and the relationship of the categories is assumed to be hierarchical in only one direction. Bloom implies that "comprehension" presupposes "knowledge" but that "knowledge" does not presuppose "comprehension."

The taxonomy, seen as a one-way hierarchy, leads the reader to conclude that knowledge is always a simpler behavior than comprehension, and comprehension a simpler behavior than application. There is a significant sense in which this view is misleading. The achieving of any knowledge always presupposes some, at least minimal, comprehension, application, analysis, synthesis and evaluation. This insight is essential for well-planned and realistic curriculum designed to foster critical thinking skills, abilities and dispositions. Successful critical thinking instruction requires that:

1) teachers have a full range of insights into the cognitive processes and their complex interrelations;
2) Bloom's hierarchy should be seen as two-sided; and,
3) rational learning is viewed as process as well as product oriented, a process that brings comprehension, analysis, synthesis and evaluation into every act of the mind.

Christenbury and Kelly (1983) concur in this view of the use (and potential misuse) of questioning hierarchies.

They suggest that the hierarchy should be viewed as a description of cognitive processes and *not* as prescriptions for classroom questioning strategies. They cite an obvious drawback in practical usage in a dependence on extensive lists of questions prepared by the teacher so that each category or level is sufficiently "covered." They note that there is no evidence to support the implication of questioning hierarchies that one category is superior to another. Hierarchies also suggest an orderly progression from one level to another in all discussions, a progression that does not always occur in "real classrooms." And, finally, they object to rigid implementation of hierarchies (which often become prescriptions rather than suggestions or guidelines). Hierarchies imply a linear or sequential theory of learning—a theory, questionable at best.

Bearing in mind its limitations, the taxonomy can be useful in enhancing the teacher's questioning repertoire. By approaching each lesson in the context of critical thinking skills, a teacher can begin incorporating emphasis on these skills into his or her own style until they become automatic. By approaching lessons this way the teacher begins to consistently give students practice using these skills throughout the content areas. Students are then required to *do* something with the new information they are learning. They are mentally stretched in ways that make them interact with knowledge. Teachers should realize that they are not teaching critical thinking simply because they can ask questions that fall within different Bloomian categories. Teaching in a critical manner, in such a way as to foster the critical spirit, requires that each question be framed with judgment to encourage and probe the thinking of students. There are no rigid rules or sure fire recipes for doing this.

Structuring Lessons to Integrate Critical Thinking Skills.

Cornbleth (1985) notes that "we can teach for critical thinking by providing opportunity and support for student questioning and by providing instruction as needed for raising meaningful questions and pursuing well reasoned answers." The questions raised and the means needed to pursue them are "domain-specific": the various fields of knowledge have different logics or modes of reasoning. Given that fact and our still limited knowledge in this area, concludes Cornbleth, it is not possible to provide a blueprint for teaching for critical thinking. In fact, critical thinking by its very nature resists prefabrication. It cannot be reduced to a "universally applicable formula of skills": knowledgeable, thoughtful teachers have to make their own "situation-specific and appropriate decisions rather than relying on the dubious prescriptions of others."

The AFT supports this view that there is no one right way to teach for critical thinking, that the nature of one's discipline, the diversity of student learning needs and the teaching style of the teacher are all significant factors in teacher decision making and the selection of appropriate teaching strategies. The AFT also believes that many teachers are already successfully integrating critical thinking skills into their instruction and that opportunities for peer interaction to focus on this issue and share approaches and techniques will expand and enhance their abilities to extend students' thinking.

Such ideas and strategies as Bloom's taxonomy or the critical thinking lessons to follow should be viewed not as prescriptions for teaching, but as useful tools to guide one's practice. The professional discretion and integrity of the teacher (who on the average makes ten major instructional decisions per hour!) needs to be carefully guarded in any school-wide or district-wide approach to integrating critical thinking into the curriculum.

Edys Quellmalz of Stanford University has developed an approach that provides direct instruction of an explicit set of strategies. Her model offers one way to integrate critical thinking skills into the existing curriculum. She too argues that contrary to current practice and some educational philosophies, children at all age levels are capable of thinking critically. As part of the Higher Order Thinking (H.O.T.) Project, she has developed model lessons designed to guide students through a process of purposeful information gathering, analysis and interpretation, and explanation of conclusions.

The predominant approach is *to have students write about material they read as part of their usual class assignments* with the objective of the lesson emphasizing four critical thinking skill areas: analysis, comparison, inference/interpretation, or evaluation. The approach generally involves eight components:

1. Goal: telling students the focussing question for the lesson;
2. Introduction/Plan: a) discussing the relevance and importance of the thinking skill; b) explaining and modeling use of the thinking strategies; c) reviewing background experiences relevant to the story; and d) reviewing appropriate information gathering strategies;
3. Read/Gather Information: guiding students through a process of purposeful reading (or remembering, if the assignment draws primarily upon background experience);
4. Analyze/Interpret: analysis, comparison, interpretation or evaluation of information;
5. Write/Synthesize: writing (or presenting) the generalization/interpretation/evaluation and reasons supporting it;
6. Assess: evaluating/reviewing the essays/presentations;
7. Revising/Reviewing: discussing ways to improve the particular assignment and approaches to similar ones.
8. Transfer: discussing how the thinking strategies can be used in other academic and practical areas.

A lesson developed for third grade illustrates the approach. Students read a version of Jack and the Beanstalk in their Junior Great Books series to interpret Jack's character. (See Tables I and II) The assignment asked whether Jack was a greedy or curious person. The discussion and two sample essays clearly illustrate students' lively and imaginative, yet reasoned, interpretations of Jack's actions. The lesson is designed as follows:

Table I

Jack

I think Jack was grai
One; I think he was
greedy to go up to the
house to get the golden
harp because he already
had a hen. Two, I think he
was greedy to steal the hen
instead of the egg.

11

Table II

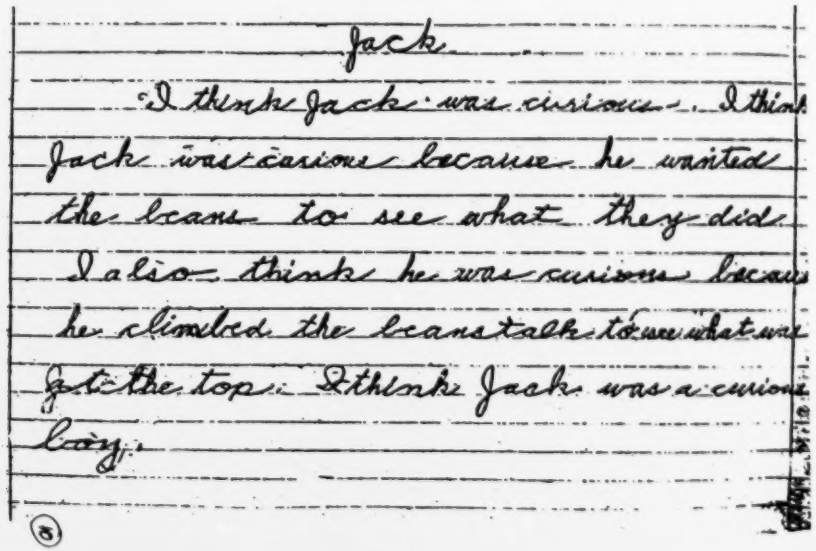
Jack
I think Jack was curious. I think
Jack was curious because he wanted
the beans to see what they did.
I also think he was curious becaus
he climbed the beans talk to see what was
at the top. I think Jack was a curious
boy.
8

Table III

Position: I Disagree

Examples

Name of TV show	Why it is use or harmful
1 Electrict company	1 Teachs you how to read and spell
2 3-2-1 Contact	2 teachs you siense
3 Happy Days	3 teachs you how to be happy

Table IV

TV

I ~~agree~~ disagree that we should unplug all the TV's. The show "SeSame Street" teaches children the alphabet. The show "Romper Room" teaches children game. The show "321 Contact" teaches children Science.

A SAMPLE FROM THE HIGHER ORDER THINKING (H.O.T.) PROJECT GRADE 3

Thinking Skill Objective: Infer/Interpret

Lesson Objective: Students infer a character trait by writing an essay in which they explain whether Jack (Jack and the Beanstalk) was a curious or a greedy boy.

Materials: Jack and the Beanstalk in Junior Great Books, Series 3. Planning sheets.

LESSON ACTIVITIES

Set the Goal: Tell students that they will be reading the story, Jack and the Beanstalk and writing a composition in which they figure out and explain whether Jack is a greedy or curious boy.

Plan/Introduce:

Introduce the lesson by explaining to students the importance and relevance of being able to INTERPRET (figure out/think about) elements of a story such as character traits (what a character is like), or the relationship of setting to the plot in order to understand and appreciate the story. Suggest some previously read or well known stories where knowledge of the character trait helps the reader to understand the story. Suggest personal and community situations where knowing how to figure out a character trait is relevant, e.g., choosing friends, voting.

Discuss the strategy appropriate to the thinking skill: Identify the possible traits; decide what information about the character is relevant; read to gather information about the character; sort and judge evidence that relates to one of the traits; explain how the evidence supports selection of a trait; recognize plausible alternative interpretations.

Model or review the process for a well known character.

Review background knowledge about the story: Ask students to summarize briefly what they remember about the story.

Review strategies for getting information from the story: Ask students what kinds of things people do who are greedy or who are curious. Suggest that students watch for curious or greedy behaviors as they read the story.

Read/Gather Information

Ask students to read the story silently.
Review: Ask students to discuss the main events in the story. Write/map these events, in sequence, on the board.

Analyze/Interpret

Write two headings on the board, "Jack was curious." "Jack was greedy." Ask students to suggest things that Jack did or felt that they think fit under one heading or the other. Encourage them to speculate about why Jack did each thing.

Write/Synthesize

Plan

On the board write the assignment, "Write an essay in which you explain whether Jack was a greedy or a curious boy."

Distribute the Planning Sheets and ask students to suggest topic sentences that will tell the reader which trait they have picked. Circulate and help students as they write their topic sentences next to the heading "Topic Sentence" on their Planning Sheet.

Ask students to write two or three supporting sentences next to the heading "Support" on their Planning Sheet. Circulate and help students to list and explain how Jack's actions relate to the chosen character trait.

Have students write a summary sentence next to the heading "Conclusion" on their Planning Sheet.

Write/Present

Now ask students to write their compositions. Circulate and help.

Read students' compositions and comment on the topic sentences, supporting sentences and conclusion. Be sure supporting sentences present both *what* Jack did and *why* it is an example of a trait.

Review/Revise

Revise: Return the compositions. Read some particularly strong reasons and or selected elements. Ask students to suggest alternative explanations. Ask students to suggest ways to strengthen or replace weak reasons. Circulate and help students as they revise their compositions.

Review: Ask students to review and discuss the thinking strategies they used to infer (figure out) a character trait.

Transfer

Discuss how students could use the same thinking strategies to figure out character traits in other stories, e.g., Was Jason (in *Jason and the Argonauts*) a lucky or brave person?

Discuss other areas of application, e.g., Is the new coach mean or just tough? Was Columbus heroic or greedy?

Another second grade lesson calls for students to respond to the statement, "Children spend too much time watching TV. If we unplugged all the TV sets in America, children would be better educated."

The second graders discuss the structure of an argument: position and reasons, as well as strong vs. weak reasons, (facts, examples, vs. personal preference, generalizations). They then create on a planning sheet their position and the names of three shows and reasons why each is useful or harmful. The two examples show that second grade children can marshall support for their position. (See Table III-IV)

The ideal is to take those first steps that initiate the teaching of relatively "self-contained" critical thinking skills: testing for inferences that explicitly do or do not follow, for recognition of assumptions and clear-cut contradictions, for reasons to support conclusions, for considerations of evidence rather than reliance on authority. In the process, wherever possible, students should be given opportunities to advance ideas of their own and to give reasons to support them, as well as opportunities to hear the objections of other students. If this is done carefully in an atmosphere of cooperation and support, the students will begin to use critical distinctions in defending their judgments. When this integration begins, a very healthy process has been set in motion which, properly nurtured can lead to critical thinking in the "strong" sense—an internalization of the "critical spirit."

D. Writing and Critical Thinking

In researching the development of children's writing, Lucy McCormack Calkins, director of the writing project at Teachers College, Columbia University, had many observations about the way we teach writing, and about the development of students' thinking through writing.

In a two-year study of third and fourth graders, Caulkins (1984) made several observations: "Youngsters whipped off papers in quick bursts, writing without much forethought or deliberation. 'Get it done' seemed to be the motto. The pace is one we all know well, for ours is a first-draft-only society, a land of frozen waffles, easy divorces, of commercials every seven minutes. Detachment is built into a time frame like this."

She found the teaching of writing of little priority or time investment. Many teachers did not feel comfortable teaching writing. When new or fresh approaches were attempted, the students (used to being told what to do and write, having their thinking done for them) were lost: "Children who are fed topics, story starters, lead sentences . . . as a steady diet . . . rightfully panic when topics have to come from them. The anxiety is not unlike that of the child whose mother has just turned off the television set. 'Now what do I do?' bellows the child. Suddenly their act depends on them and they are unused to providing their own motivation and direction."

She notes that according to the Piagetian growth model, organisms do not just grow on their own, but in response to interactions which challenge them, interactions which dislodge one equilibrium so a new one can be reached. One of the tasks of the writing teacher is to intervene—with sensitivity and a sense of timing so as to nudge children toward new discoveries.

By designing writing activities to "nudge" children, such as the above Stanford example, we help children develop their critical thinking skills by having them think about their writing. By asking questions of their work (What problems are you trying to solve? How did you go about doing that?) we are developing students' metacognitive strategies. They think about their thinking, they think about ways in which to expand and refine their ideas in written form. Some of the questions teachers used to help students "think through" their writing (clarification) in Calkins' study were:

- Helping writers focus: What is the most important thing you are saying? Why did you choose this topic? Why is it important to you? Which is the most important part of the story? Why? (evaluation) Is there anything that doesn't seem to fit? (consistency)
- Helping writers show—not tell: Read me the places where you're pleased with your description. What makes this section better than others? (evaluation, analysis) Are there places you could describe more?
- Helping writers expand their pieces: What questions do you think people will have for you? (predicting) Why don't you try reading your story over and put a dot over the page that needs adding? (evaluation)

By infusing thinking skills into writing assignments, we develop both the writing and the thinking of our students. Some forms of writing lend themselves to the development of critical thinking as such (as in the sample Stanford lesson), yet in other types of writing which do not explicitly call for specific critical thinking skills (creative writing), fundamental critical thinking skills as shown here, can be applied to the process of improving, refining and extending the writer's work.

E. READING AND CRITICAL THINKING

In their classic text *How to Read a Book: The Classic Guide to Intelligent Reading*, Mortimer Adler and Charles Van Doren (1972) say that "good books are over your head. They would not be good for you if they were not . . . only books that are beyond you will make you stretch your mind." Reading can be more or less active, the more active the better. Active reading involves the asking of questions. To be informed, they say, is to know simply that something is the case; to be *enlightened*, however, is to know in addition, what it is all about, why it is the case, and what its connections are with other facts. In other words, to be enlightened one needs to read critically, or think critically while reading.

The effectiveness with which we read, as in anything else, is determined by the amount of effort and skill we put into it. These authors continue: "Our continuing education depends mainly on books alone, read without a teacher's help, therefore if we are disposed to go on learning and discovering, we must know how to make books teach use well." If our ultimate goal in school is to nurture lifelong learning, we cannot better serve our children than by giving them the tools to do so. Thinking critically while reading moves us from "knowledge" to "knowing," from being "informed" to being "enlightened."

Adler and Van Doren identify four levels of reading. They are:

I. **Elementary Reading** - the rudiments, the initial reading skills learned in elementary school.

II. **Inspectional Reading** - characterized by an emphasis on time—a set time to complete an assigned amount of reading. The aim is to get the most out of a book within a given time—skimming systematically.

III. **Analytical Reading** - more complex and more systematic, a thorough and complete "chewing and digesting" of a book, preeminently for the sake of understanding.

IV. **Syntopical Reading** - the most complex and systematic type; also called comparative reading: reading many books in relation to one another and to a subject about which they all revolve; the syntopical reader is able to construct an analysis of the subject that may not be in any of the books; the highest, most active and effortful type.*

Just as we make the claim that we overemphasize didactic instruction to the detriment of coaching and discussion, we might also claim that the "higher order" reading skills of analytical and syntopical reading are also neglected. These levels involve the application of critical thinking skills to reading, a skill essential to all disciplines. Yet if we are not fully developing and nurturing these skills in our instruction, in our questions, in our tests, are we emphasizing them enough in teaching reading, in using reading as a vehicle for acquiring knowledge?

To do this we must help students learn the "rules" for analytical reading. We need to incorporate the skills the rules cover into our expectations for our students and provide many opportunities for practice and discussion. As was noted in the "Discussion" section, by discussing ideas and concepts gleaned from reading, the student develops a thorough understanding of the material, is required to process the information more deeply.

Research has suggested that questions which are interspersed in reading passages and which require students to apply what they have learned leads to superior results in comprehension and retention. Regular and frequent use of questions in reading material has been shown to improve student mastery of content. Students score better on tests given at the end of a reading assignment if they have been asked questions as they go along. This may also increase their ability to ask questions themselves when the questions aren't there anymore.

Some of the "rules" of analytical reading include the critical thinking skills discussed here:

- defining the problem the author has tried to solve;
- interpreting the author's key words and use of terms;
- identifying the author's arguments and overall point of view;
- recognizing the difference between knowledge and personal opinion by presenting good reasons for critical judgments;
- showing where the author is uninformed, misinformed, illogical or incomplete;
- determining which of the problems the author has solved, and which he has not.

These skills need to be developed early and built upon in every grade level and every subject area. The following are some questions from Calkins' study to help elementary school children to begin to look critically at stories they read:

- The Lead: Does the author make me want to read on? How? When I read it, what do I expect will follow in the book?
- The Characters: Which of the characters seems most real? Why? What makes some of the characters work better than others?
- The Point-of-View: Who tells the story? Why might the author have decided to do it this way? Does this way work? How else might it have been done? What can I learn from the author's treatment of point of view?
- The End: Does the end relate back to the beginning? Does it feel like "The End"?

These approaches can entice children to like books that are "over their heads."

F. CRITICAL THINKING AND THE DISCIPLINES

Teachers lament the fact that virtually no commercial

*reprinted by permission of Simon and Schuster, Inc. © 1972 by Mortimer Adler and Charles Van Doren.

materials are available on how to teach critical thinking skills. O'Reilly (1985) says that in history, for example, despite the fact that historians rarely agree with each other, it is extremely difficult to recognize any arguments at all in most textbooks. They generally do not present rival interpretations. Just the revelation that there are conflicting viewpoints at all, he says, is a surprise to many students and serves to counter the "textbook truth" syndrome.

While textbooks and instructional materials have been deficient in their attention to thinking skills, things do appear to be changing since the emergence of this recent "critical thinking movement." The ASCD Collaborative of 20 national education groups intends to influence publishers with standards and criteria for infusing thinking skills meaningfully into their publications. In the meantime, teachers have to "make do" with existing curricula and materials—in a sense building the airplane as we fly. This includes a thorough understanding of the critical thinking skills and dispositions, but also the ability to think critically within their disciplines.

As noted, critical thinking is domain specific and knowledge dependent. Various fields of knowledge have different logics or modes of reasoning (Cornbleth, 1985). Critical thinking varies with the domain being investigated, and an effective teacher needs to understand the domain in this way and develop a sense of when the situation (concept, discussion, activity) warrants the use of a particular thinking skill or skills. The teacher needs to know how to present and use the subject to build an organized representation and interpretation for students. Information that is organized and elaborated with a predisposition to thinking critically about it enables students to conceptualize it, make relationships with it and draw connections from it, thereby making it much more meaningful and lasting.

Here are some examples of various critical thinking skills which can be successfully developed in these sample subjects, taken from D'Angelos' *The Teaching of Critical Thinking* (1971).

■ Language Arts

Sample Skills: the meaning of concepts
analyzing the use of language
identifying faulty reasoning
infering meaning from a story
identifying the use of bias, emotive language

Sample Activity: The use of thought-provoking statements as topics for writing compositions: Socrates said, "The unexamined life is not worth living." What is an unexamined life? Is it possible for someone to lead an unexamined life? What arguments can be used to justify this belief? Are there any justifiable arguments for the contrary position? These questions involve the use of definitions, evidence and analysis of arguments.

■ Social Studies

Sample Skills: analyzing issues and social problems
distinguishing fact from opinion
examining assumptions
seeking evidence
drawing conclusions

Sample Activity: Using a newspaper editorial as the focus of evaluating evidence, having the students ascertain the following: Did the writer actually observe and describe the event? Did any emotional factor interfere with his observations? Is the observer competent to make this judgment? Or using an election year as an opportunity to encourage critical thinking by having the students seek answers to the following questions: How do you establish criteria for selection among candidates? What qualities do you look for? How do you determine whether the candidate has the ability to govern wisely? What are the relevant and irrelevant factors in judging the ability of a candidate?

■ Mathematics

Sample Skills: the use of definitions
identifying assumptions
making deductive proofs
distinguishing between relevant and irrelevant evidence
recognizing fallacious reasoning

Sample Activity: Having the students teach some of the concepts to each other, thereby promoting discussion of the concepts, clarification of the concepts and a deeper understanding of them. Proposing a problem and its solution and having students in small groups identify the evidence available for its solution and then distinguishing which of the evidence led the mathematician to the correct solution. Giving students examples of problems with correct and incorrect answers and having them detect correct and incorrect reasoning leading to those with errors.

■ Art

Sample Skills: interpretation
analyzing the components of a composition
evaluating the uses of various kinds of media
recognizing appeal to emotions
making inferences on the artist's intentions

Sample Activity: Presenting an art object to the class without introduction and having them develop the questions that they might like to ask about it. Then they are to evaluate the questions they have posed and suggest ways to answer them.

In this chapter the process for beginning a transformation of emphasis toward infusing our curricula with critical thinking was described. The Paideia Proposal and its usefulness in thinking about critical thinking were explained. Essential components of "communities of inquiry" were described: classroom climate, questioning and discussion strategies and the design of lessons to integrate critical thinking skills. Actual examples for building these skills into classroom lessons were given. This transformational process is a long term—perhaps never ending—one as we strive to make the subjects we love meaningful for our children.

CHAPTER 4: EVALUATING CRITICAL THINKING

A. Reassessing Current Assessment Measures

Benjamin Bloom (1984) has noted that 95 percent of our standardized test questions are devoted to testing for knowledge and recall, and neglect the higher level thinking processes. This is due in part to the fact that it is easier to develop tests of knowledge and information that have statistical reliability than those that measure critical thinking ability. If we are to emphasize critical thinking as the central endeavor of the educational process, then a reexamination of our assessment measures is necessary. We must develop new, better and more extensive strategies for assessing critical thought.

As with the emergence of the critical thinking movement itself, a reassessment of achievement testing is already underway in many places. Connecticut, Michigan and California, for example, are developing new tests or redesigning existing tests to assess critical thinking. The California State Department of Education is preparing tests in reading and writing, math and social studies incorporating critical thinking skills in 30 to 60 percent of the test items (30 percent in the early grades, 40 percent at grade 8, and 60 percent at grade 12). State-wide committees are working with teachers throughout the state to develop items to be used in the California Assessment Program (C.A.P.) tests. In 1985, 300,000 California eighth grade students, for the first time, took a history/social science test in which 40 percent of the test items (which were multiple choice) focused on critical thinking skills.

According to Kneedler (1984), the C.A.P. program is not meant to replace teacher-made assessment instruments or observation, but to provide school personnel with information on program strengths and weaknesses, and information on the performance of different groups. He notes that one of the dangers of any testing program that assesses knowledge is the tendency to trivialize the content area and narrow the curriculum. Recall questions are easy to write and if what is tested is all that is taught, teachers may be forced to address only factual knowledge and students to become solely concerned with memorization. Processing information and solving problems are neglected. Tests, like textbooks, that cater to a large and varied audience, often regress to a narrow mean. What suffers is critical thinking.

Cognizant of these dangers, Kneedler says, the statewide assessment advisory committee decided to place a heavy emphasis on critical thinking skill items that require process, not recall. The committee decided that 40 percent of the assessment questions should address critical thinking skills at grade 8 and 60 percent at grade 12. They used three different approaches to assessment: objective questions, the critical thinking skills (CTS) vocabulary, and the student essay.

The major part of the CTS assessment consists of objective questions (see below) but there is also a critical thinking writing requirement that will be an integral part of the assessment. (The writing exercise will be optional for districts and scoring will be done at the local level.) The assessment component of the CTS vocabulary requires students to demonstrate their understanding of terms associated with critical thinking such as generalization, hypothesis, inference, premise, etc. The following 12 critical thinking skills are included in the C.A.P. social studies test.* Sample items are given for each:

A. Compare similarities and differences

The ability to compare similarities and difference among two or more objects, living things, ideas, events, or situations at the same or different points in time. Implies the ability to organize information into defined categories.

SAMPLE ITEM:

In the late nineteenth century, western vigilantes and southern Ku Klux Klan (KKK) members were similar in what way?

a. Both took the law into their own hands.
b. Both were concerned with jury trials.
c. Both were against violence.
d. Both found jobs for immigrants.

B. Identify central issues or problems

The ability to identify the main idea or point of a passage, argument, or political cartoon, for example. At the higher levels, students are expected to identify central issues in complex political arguments. Implies ability to identify major components of an argument, such as reasons and conclusions.

SAMPLE ITEM:

It used to be said that "the sun never set on the British Empire." What does this saying mean?

a. The sun shines 24 hours a day in England.
b. The British had colonies around the world.
c. The future looked bright for the British.
d. It is always very warm in England.

C. Distinguish among fact, opinion and reasoned judgment

Defined as the ability to apply criteria for judging the quality of observation and inference.

SAMPLE ITEM:

Which one of the following statements about the United States Congress is a FACT rather than an opinion?

a. Congress works too slowly.
b. Congress is overpaid.

*From Assessment of the Critical Thinking Skills in History—Social Science, *California Assessment Program: 1984*.

c. Congress wastes money.
d. Congress makes our laws.

D. Recognize stereotypes and cliches

Defined as the ability to identify fixed or conventional notions about a person, group or idea.

SAMPLE ITEM:

Patrick has always liked typing and shorthand. Although his parents wanted him to learn computer science, Patrick went to a clerical instructor to discuss a secretarial career. Ms. Rodriguez laughed at him and said, "Patrick, why on earth do you want to become a secretary? You can make a lot more money in men's fields."

What stereotype is implied in the above statement?

a. A computer technician career is better than a secretarial career.
b. Shorthand instructors do not make much money.
c. A secretarial career is for women.
d. Secretarial tasks are difficult to learn.

E. Recognize a bias, emotional factors, propaganda, and semantic slanting

The ability to identify partialities and prejudices in written and graphic materials. Includes the ability to determine credibility of sources (gauge reliability, expertise, and objectivity).

SAMPLE ITEM:

A juror may be excused from serving on a jury for "just cause." A just cause might include bias, prejudice, knowledge of the defendant, or personal acquaintance with the crime.

Which of the following jurors would be acceptable in the trial of a white defendant for the murder of a black police officer?

a. Alex Peters, the husband of one of the witnesses to the shooting.
b. Karen Marley, who works for the police department as a dispatcher and has taken up a collection for the dead officer's widow and children.
c. Lois Adams, who lives in the same neighborhood as the defendant, but who has never met him.
d. Mark Jones, a member of a white supremist organization called "The Knights of White Power."

F. Recognize different value orientations and different ideologies

The ability to recognize the similarities and differences among different value orientations and ideologies.

SAMPLE ITEM:

Suppose that a journalist around the turn of the century asked, "How can labor's aims be met in the face of the overwhelming strength of industry?"

Which one of the following answers might Samuel Gompers (1850-1924), a famous labor leader, have given?

a. "Workers must be willing and eager to use violence to get what they want."
b. "Workers must trust in the goodness and fairness of management to grant them as many of their demands as they deserve."
c. "Workers should pressure management to agree to collective bargaining, a method whereby labor unions represent workers and try to get contracts from management to meet the worker's needs."
d. "Only threats and harassment will influence management when it comes to securing good working conditions and decent pay for employees."

G. Determine which information is relevant

The ability to make distinctions between verifiable and unverifiable, relevant and nonrelevant, and essential and incidental information.

SAMPLE ITEM:

What would help you the most in making a decision about a candidate for governor of the State of California?

a. his or her record in other political office
b. what the newspaper editorials say about the candidate
c. his or her statements about himself or herself
d. what television commercials say about the candidate

H. Recognize the adequacy of data

The ability to decide whether the information provided is sufficient in terms of quality and quantity to justify a conclusion, decision, generalization, or plausible hypothesis.

SAMPLE ITEM:

The following figures from the U.S. Bureau of the Census show the percent of eligible voters who cast ballots in national elections.

1968	1972	1976	1980
60.9%	55.2%	53.5%	52.6%

Based upon these figures, you can conclude that

a. political candidates are less qualified than they used to be.
b. a majority of Americans don't vote.
c. voter turnout has been steadily declining for more than a decade.
d. voter participation has reached an all-time high.

I. Check consistency

The ability to determine whether given standards or symbols are consistent. For example, the ability to determine whether the different points or issues in a political argument have logical connections or agree with the central issue.

SAMPLE ITEM:

Bill Jones, a candidate for Congress, says that his is in FAVOR of the following ideas:

1. lowering taxes
2. reducing government spending

3. increasing expense accounts for legislators
4. eliminating waste in government

Which idea is INCONSISTENT with his other three ideas?

J. Formulate appropriate questions

The ability to formulate appropriate and thought-provoking questions that will lead to a deeper and clearer understanding of the issues at hand.

SAMPLE ITEM:

Which of the following questions would be the MOST important to ask in determining whether someone had a fair trial?

a. What was the ethnic background of the judge?
b. Was the accused guilty?
c. Was the judge a man or a woman?
d. Did the accused receive all of his or her Constitutional rights?

K. Predicting probable consequences

The ability to predict probable consequences of an event or series of events.

SAMPLE ITEM:

Suppose that United States farmers experienced several years of drought. Many cattle died because of lack of water and inadequate food.

What do you think would happen to beef prices?

a. People would import less beef.
b. The price of beef would rise.
c. The price of beef would drop.
d. Beef would completely disappear from grocery stores.

L. Identify unstated assumptions

The ability to identify what is taken for granted, though not explicitly stated, in an argument.

SAMPLE ITEM:

In 1948, Mr. Smith told his neighbor that John Dewey would be our next President because the public opinion polls said he would win. What assumption was Mr. Smith making?

a. Public opinion polls are always accurate
b. John Dewey's opponent was lacking in experience
c. Voter turnout would be low
d. Opinion polls are usually wrong.

These preliminary efforts at revising existing assessment procedures, though covering only the most elemental forms of critical thought, illustrate the possibilities of broadening the measurement of learning. The examples cited have been designed to fit the multiple-choice format of a state-wide assessment instrument. Cartoons, maps, pictures and items other than narrative are used. The limitation of the multiple-choice type of instrument is that it cannot really measure extended use of critical thinking skills, but rather the discrete use of such skills.

Connecticut is beginning its critical thinking testing at the fourth grade. Since there is yet to be developed a definitive body of research on the thinking capabilities of young children, test developers relied on the insights of experienced teachers, fourth grade students, and expert judgement. Despite the preference for an essay test as a better measure of what students actually are thinking, a multiple choice format was adopted because of the economy of administration. Eleven abilities were selected. They are the ability to:

1. identify central issues, and problems
2. identify conclusions
3. identify reasons
4. identify appropriate questions to ask, given the situation
5. identify assumptions
6. determine credibility of sources of information
7. determine relevance
8. recognize inconsistency
9. infer and judge deductive validity
10. deduce and judge deductive validity
11. predict possible consequences

The items were embedded into two separate story themes: putting on a play and cleaning up a park. The stories were used not only to maintain interest but to provide content for each item.

The first test tryout occurred in the fall of 1984. The developers, thinking that reading ability might skew the results, split the tryout group into two sections. One group had to read the test themselves and the other group had the items read to them while they looked at the items. (This difference in procedure did not affect internal consistency, but the group read to had a higher mean percentage of correct answers.)

It was found that "identifying conclusions" and "identifying assumptions" were problem areas for the students. Part of the problem may be that students do not really know or understand the meaning of the words "assumption" or "conclusion." As with the findings of the major reading assessment of 100,000 U.S. school children, this is probably due to the fact that these were unfamiliar tasks being asked of them, not due to any cognitive inability to think analytically. Robert Ennis observes that fourth grade teachers whom he has consulted on the matter universally agree that average fourth graders can learn these skills, and he says, "I am inclined to believe them, because they should know." The research to document these assumptions and others about the teaching and testing of critical thinking has yet to be done.

B. Nationally Available Critical Thinking Tests

Most critical thinking tests currently available are multiple choice tests. Robert Ennis, Professor and Director of the Illinois Thinking Project at the University of Illinois, Urbana-Champaign, has developed a list of such tests. Ennis' list includes the following:

Basic Skills for Critical Thinking (1979), (5 forms) by Gary E. McCuen. Greenhaven Press, Inc., 577 Shoreview Park Rd., St. Paul, MN 55112. (This test is aimed at high school students and includes sec-

tions on source of information, primary and secondary sources, fact and opinion, prejudice and reason, stereotypes, ethnocentrism, library card catalogue, and *Reader's Guide Periodical Literature*.)

Cornell Critical Thinking Test, Level X (1985) by Robert H. Ennis and Jason Millman. Illinois Thinking Project, Ed. Bldg., Univ. of Illinois, Champaign, IL 61820. Soon to be available from Midwest Publications, P.O. Box 448, Pacific Grove, CA 93950. (The Cornell test is aimed at grades 4-14 and includes sections on induction, credibility, observation, deduction, and assumption identification.)

Cornell Critical Thinking Test, Level Z (1982) by Robert H. Ennis and Jason Millman. Illinois Thinking Project, Ed. Bldg., Univ. of Illinois, Champaign, IL 61820. Soon to be available from Midwest Publications, P.O. Box 448, Pacific Grove, CA 93950. (This test is aimed at advance or gifted high school students and college students. It includes sections on induction, credibility, prediction and experimental planning, fallacies (especially equivocation), deduction, definition, assumption identification.)

New Jersey Test of Reasoning Skills (1983) developed by Virginia Shipman. IAPC, Test Division, Montclair State College, Upper Montclair, NJ 07043. (The New Jersey Test of Reasoning Skills is aimed at grades 4 - college. The syllogism is heavily represented and there are several items apiece on assumption identification, induction, good reasons, kind and degree.)

Ross Test of Higher Cognitive Processes (1976) by John D. Ross and Catherine M. Ross. Academic Therapy Publications, 20 Commercial Blvd., Novato, CA 94947. (This critical thinking instrument is aimed at grades 4 - college. It includes sections on verbal analogies, deduction, assumption identification, word relationships, sentence sequencing, interpreting answers to questions, information sufficiency and relevance in mathematics problems, analysis of attributes of complex stick figures.)

Watson-Glaser Critical Thinking Appraisal (1980), (2 forms) by Goodwin Watson & Watson Maynard Glaser. The Psychological Corporation, a subsidiary of Harcourt Brace Jovanovich, 7500 Old Oak Boulevard, Cleveland, OH 44130. (The Watson-Glaser is aimed at grade 9 through adulthood, and includes sections on induction, assumption identification, deduction, conclusion-logically-following-beyond-a-reasonable-doubt, argument evaluation.)

The questions on the *Watson-Glaser Critical Thinking Appraisal* or any of these instruments provide models for teachers to develop their own lessons, questions and test items. The section in the Watson-Glaser on *inference*, for example, first provides a definition of the term ("a conclusion a person can draw from certain observed or supposed facts.") The directions then ask the test-taker to examine each inference given and to make a decision as to its degree of truth or falsity: true, probably true, insufficient data, probably false or false. This example is given:

EXAMPLE ON INFERENCE

Two hundred students in their early teens voluntarily attended a recent weekend student conference in a Midwestern city. At this conference, the topics of race relations and means of achieving lasting world peace were discussed, since these were the problems the students selected as being the most vital in today's world.

1. As a group, the students who attended this conference showed a keener interest in broad social problems than do most other students in their early teens.
2. The majority of the students had not previously discussed the conference topics in their schools.
3. The students came from all sections of the country.
4. The students discussed mainly labor relations problems.
5. Some teenage students felt it worthwhile to discuss problems of race relations and ways of achieving world peace.

An *assumption* is defined as "something presupposed or taken for granted." Students are asked to read a statement and several proposed assumptions and to decide whether they are taken for granted or not. The following example is given:

EXAMPLE ON ASSUMPTIONS

Statement: "We need to save time in getting there so we'd better go by plane."

Proposed Assumptions:

1. Going by plane will take less time than going by some other means of transportation. (It is assumed in the statement that the greater speed of a plane over the speeds of other means of transportation will enable the group to reach its destination in less time.)
2. There is plane service available to us for at least part of the distance to the destination. (This is necessarily assumed in the statement since, in order to save time by plane, it must be possible to go by plane.)
3. Travel by plane is more convenient than travel by train. (This assumption is not made in the statement—the statement has to do with saving time, and says nothing about convenience or about any other specific mode of travel.)*

The *Test on Appraising Observations* by Stephen Norris and Ruth King of Memorial University of Newfoundland can be described as a multiple-choice test whose questions are set in the contexts of stories. It is an aspect-specific critical thinking test because it focuses on just one aspect of critical thinking—observational ability. For groups for which the test is suitable, it requires approximately forty-five minutes to complete. It is designed primarily for the senior high school grades but should be useful both at the junior high school and college level. The reading level of the test is suitable for the average twelve of thirteen year old.

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The test consists of fifty items in two parts, Part A having 28 items. Part A is the story of a traffic accident, and Part B involves the exploration of a river. The stories provide enough background knowledge of the situation for decisions to be made about the appropriateness of using particular principles of appraisal in answering items. In addition, the stories help to maintain interest in the test by engaging examinees in an evolving episode.

The *Test on Appraising Observations* is closer to being a multiple-choice test than to being any other traditional kind of test. However, steps have been taken to avoid some of the most serious pitfalls which multiple-choice tests face. Each item presents examinees with two statements in bold type spoken by characters in the stories. Examinees are to choose which, if either, of the statements in bold type they have **more** *reason to believe at the time the statements are made*. There are thus three alternatives for each item: (1) the first statement is more believable; (2) the second statement is more believable; and (3) neither is more believable, they are equally believable. In the sense that there are three choices for each item, the test is multiple-choice. However, the choices for all items are the same, and each has equal plausibility. The three alternatives used on the *Test on Appraising Observations* are the logically obvious ones, given the problems posed on the test. This means that examinees are unable to eliminate distractors because of their obvious implausibility.

Examinees are instructed to choose which, if either, of the statements in bold type they have *more* reason to believe at the time the statements are made. This was a deliberate attempt to avoid asking for judgments of *degrees* of endorsement, as would have been required had the alternatives been "strongly believe the first statement, strongly believe the second statement, weakly believe the first statement, weakly believe the second statement," and so on. The problem with using this sort of format is that "people with different levels of sophistication justifiably give different levels of endorsement to a conclusion" (Ennis, 1984). Asking only for the *direction* in which the evidence points, as is done on the *Test on Appraising Observations,* is a means of obtaining higher agreement among the best critical thinkers.

SAMPLE TEST ITEMS:*

In each question you will be given two statements in bold type. You must choose which statement in bold type, if either, you have **more** reason to believe at the time the statements are made.

Remember: Choose between the statements in bold type only. You may use statements which are not in bold type to help you choose.

A traffic accident has just occurred at an intersection which has a stop sign in each direction. Several cars were involved.

A policeman and a policewoman will question people. Later several investigators will collect information about the accident. It is your job to judge the evidence given in the statements that follow.

1. A policeman is questioning Pierre and Martine. They were in their car at the intersection but were not involved in the accident. Martine is the driver and Pierre, who had been trying to figure out which way to go, is the map reader.

   The policeman asks Martine how many cars were at the intersection when the accident occurred. She answers, "**There were three cars.**"

   Pierre says, "No, **there were five cars.**"

2. A small boy and his father had been standing on the sidewalk when the accident occurred.

   The boy says, "**There was a motorcycle at the intersection.**"

   His father says, "No, **there was no motorcycle at the intersection.**"

3. A policewoman has been asking Mr. Wang and Ms. Vernon questions. She asks Mr. Wang, who was one of the people involved in the accident, whether he had used his signal.

   Mr. Wang answers, "Yes, **I did use my signal.**"

   Ms. Vernon had been driving a car which was not involved in the accident. She tells the officer, "**Mr. Wang did not use his signal.** But this didn't cause the accident."

C. The Essay as a Critical Thinking Evaluation Tool

Another way to assess critical thinking is the use of the essay test. Its drawback comes from the difficulty in scoring large numbers of tests and in the unreliability of the scores. The advantages, of course, do allow for extended measures of thinking, the development of a complete line of reasoning, in-depth analysis of issues, etc. Robert Ennis and Eric Weir, in their work on testing critical thinking, have developed the *Ennis-Weir Critical Thinking Essay Test* (1985). This essay test is aimed at grade 7 through college, and Ennis says it is also intended to be used as a teaching tool. It incorporates getting to the point, seeing the reasons and assumptions, stating one's point, offering good reasons, seeing other possibilities (including other possible explanations), and responding appropriately to avoiding equivocation, irrelevance, circularity, overgeneralization, credibility questions and the use of emotive language to persuade. The test is standardized and has high inter-rater reliability. The directions and test itself follow:

DIRECTIONS

Read the letter to the editor of the Moorburg newspaper. Consider it paragraph by paragraph and as a total argument. Then write a letter to the editor in response to this one. For each paragraph in the letter you are about to read, write a paragraph in reply telling whether you believe the thinking good or bad. Also write a closing paragraph about the total argument. *Defend your judgments with reasons*.

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Your answer should have nine numbered paragraphs. Numbers one through eight should give your reactions to paragraphs one through eight in the letter. Your paragraph number nine should give your overall evaluation of the letter considered as one total argument. Each paragraph, including the last, should contain your reason(s).

Spend about 10 minutes reading the letter and thinking about it. Then write for not more than 30 minutes (about three minutes for each of your short paragraphs). The maximum total time for the test in 40 minutes.

Do not forget to give your reasons in each paragraph. Please write clearly.

Sign your name to your letter. You are a local citizen, and this topic concerns you.

Remember, write *nine numbered paragraphs* and give reasons.

THE MOORBURG LETTER

(Reprinted with permission of Midwest Publishing Co., Belmont, California.)

230 Sycamore Street
Moorburg

April 10

Dear Editor:

Overnight parking on all streets in Moorburg should be eliminated. To achieve this goal, parking should be prohibited from 2 a.m. to 6 a.m. There are a number of reasons why any intelligent citizen should agree.

1. For one thing, to park overnight is to have a garage in the streets. Now it is illegal for anyone to have a garage in the city streets. Clearly then, it should be against the law to park overnight in the streets.
2. Three important streets, Lincoln Avenue, Marquand Avenue and West Main Street, are very narrow. With cars parked on the streets, there really isn't room for the heavy traffic that passes over them in the afternoon rush hour. When driving home in the afternoon after work it takes me thirty-five minutes to make a trip that takes ten minutes during the uncrowded time. If there were no cars parked on the side of these streets, they could handle considerably more traffic.
3. Traffic on some streets is also bad in the morning when factory workers are on their way to the 6 a.m. shift. If there were no cars parked on these streets between 2 a.m. and 6 a.m., then there would be more room for this traffic.
4. Furthermore, there can be no doubt that, in general, overnight parking on the streets is undesirable. It is definitely bad and should be opposed.
5. If parking is prohibited from 2 a.m. to 6 a.m., then accidents between parked and moving vehicles will be nearly eliminated during this period. All intelligent citizens would regard the near elimination of accidents in any period as highly desirable. So, we should be in favor of prohibiting parking from 2 a.m. to 6 a.m.
6. Last month, the chief of Police, Burgess Jones, ran an experiment which proves that parking should be prohibited from 2 a.m. to 6 a.m. On one of our busiest streets, Marquand Avenue, he placed experimental signs for one day. The signs prohibited parking from 2 a.m. to 6 a.m. During the four-hour period, there was not one accident on Marquand. Everyone knows, of course, that there have been over four hundred accidents on Marquand during the past year.
7. The opponents of my suggestion have said that conditions are safe enough now. These people don't know what safe really means. Conditions are not safe if there's even the slightest possible chance for an accident. Thats what "safe" means. So, conditions are not safe the way they are now.
8. Finally let me point out that the Director of the National Traffic Safety Council, Kenneth O. Taylor has strongly recommended that overnight street parking be prevented on busy streets in cities the size of Moorburg. The National Association of Police Chiefs has made the same recommendation. Both suggest that prohibiting parking from 2 a.m. to 6 a.m. is the best way to prevent overnight parking.

I invite those who disagree, as well as those who agree with me, to react to my letter through the editor of this paper. Let's get this issue out in the open.

Sincerely,

Robert R. Raywift

CRITERIA AND SCORING SHEET FOR THE ENNIS-WEIR

The following criteria are then given for grading the test. (Except for Criteria nine, each item is worth 3 points and criteria should be used "flexibly and with judgment as adequate responses may be expressed in different ways.")

1. Recognition of misuse of analogy, and/or recognition of shift in meaning, and/or claim that incorrect definition has been stipulated.
2. Recognition of irrelevance.
3. Recognition that Paragraph Three is OK. (Neglecting the busy-streets limitation is not penalized here.)
4. Recognition of circularity, and/or recognition that no reason is offered. (Subtract one point from credit for interpreting "undesirable" as "not desired.")
5. Recognition that there may be other ways of preventing accidents, and/or recognition that other things might be more desirable, and/or recognition that there probably isn't much traffic at that time and/or recognition that other types of accidents are unaffected, and/or recognition that no evidence has been given that such accidents occur. (Other possibilities.)
6. Recognition of lack of controls, and/or inadequate sampling, and/or "only one case," and/or post hoc fallacy." (Other possible explanation)
7. Recognition of winning argument by definition, and/or recognition that a word has been made useless for empirical assertion, and/or claim that an incorrect definition has been asserted.
8. Recognition that Paragraph Eight is OK. (Neglecting the busy-streets limitation is not penalized here.)
9. One point for just condemning the overall argument: another point for reviewing or summarizing the responses to the other paragraphs in some reasonable way; two points for recognizing (anywhere) the error of concluding about all streets on the basis of reasons that relate only to busy streets; and one point for noting (anywhere) that Raywift has attempted to push people around with his emotive language. Total possible: 5 points.

This exercise is a good example not only of critical thinking assessment techique but of the application of critical thinking skills so vitally necessary for real life (such as critically reading the newspaper or critically listening to public figures on social, political or moral issues). While students spend considerable amounts of time reading and analyzing this editorial, the average adult may spend only two or three minutes. The ultimate goal of developing and enhancing critical thinking skills is the integration of these critically important skills into one's repertoire of reading, thinking, writing, speaking and listening habits. As Adler et. al. note, education only happens with continued learning throughout life.

D. Considerations for Assessment of Critical Thinking

Tests of verbal and mathematical reasoning abilities are among the oldest psychometric devices (used most frequently in the military). Data on the use of such tests indicate that these reasoning abilities retain their relevance over time and across activities to a remarkable degree. Verbal and mathematical reasoning skills also show a consistent positive relationship to successful performance in all academic fields. In studies of adults, there have been strong correlations between these reasoning abilities and occupational success, competence and productivity (Lerner, 1984). These are the goals that the schools hope to achieve in preparing their students for satisfying lives and for productive participation in society.

The following issues need to be considered in the development of reasoning/critical thinking tests:

■ The purpose of the test:

We don't want to place teachers in a position of having to teach to the test. Says Ennis, "If a test were perfect, teaching to the test would be okay. But no test is perfect, and, especially if it were multiple choice, the test might not assess all the important skills." The purpose of the test and its relationship to the existing curriculum must be defined, and the test and the curriculum need to be related to the overall goals of education.

■ What skills are to be measured:

Ennis also says that typical verbal reasoning tests (the ETS analytic reasoning components of the GRE, for example) generally test for verbal analogies and syllograms (deduction) only. He fears the neglect of many other important aspects of verbal reasoning such as induction, judging and interpreting meaning, assumption finding, reasoning within various points of view, etc. Test-makers have trouble getting "right" answers because people bring different assumptions to the tests and can justifiably come up with different answers. Also a consideration is the fact that a test might leave out the practical problems of real life, for which the development of critical reasoning is also intended. A test that covers the verbal (the humanities), the technical (math and science) and the global (issues that transcend disciplines or cross categories, i.e. gun control) would be more comprehensive.

■ Reasoning vs. critical thinking:

A test of critical thinking would be an assessment of a wider range of skills than a reasoning test. Critical thinking involves the skills of assuming, conceiving, interpreting *in addition* to the more narrow concept of reasoning, which involves inferring from premises to conclusions. A reasoning test usually covers a smaller range of skills than critical thinking covers. More important than what the test is called, however, is paying attention to what skills get into the test.

- **Type of test:**

  Whether the test will be a multiple choice test or essay test is an important consideration, as essay tests are viewed as much more desirable (though less reliable) than multiple choice tests. Multiple choice tests don't and can't test for all the important skills, while essay tests, though better, are more difficult to administer and more time consuming. If samples of students were tested, however, the essay format might be a real option.

- **Inservice teacher education:**

  Teacher education is essential for teachers who will be held accountable for their students' reasoning abilities and for their students' performance on tests being developed to assess these skills. If a "theory of teaching thinking" is non-existent in most teacher training programs, teachers cannot be expected to automatically integrate these skills into the curriculum nor to assess these skills. Far more than the usual inservice is necessary for a real integration of the concept into teaching practice. Meaningful staff development on the types of tests available. and how to integrate these skills into teacher-made tests is essential.

The research on critical thinking testing is still preliminary. (For an overview of considerations and cautions of the reliability and validity of critical thinking testing, test construction and use, see Tomko and Ennis, 1980.) There is much to be done in this area as well as other aspects of critical thinking research (effectiveness of various teaching strategies, correlations with student achievement in basic skills, etc.). Now that critical thinking is *becoming* an issue, perhaps the support for such research will follow. There will continue to be a need for large-scale research, development and dissemination as well as for educators trained in developing and reviewing critical thinking tests and materials. Any efforts to choose critical thinking tests or revise existing tests will require "rational thinking" and "reasoned judgment" to avoid merely adding another dimension to teacher accountability.

This section provided some arguments for reassessing our current assessment measures. Specific examples from the C.A.P. (California Assessment Program) have been given to illustrate how critical thinking skills can be measured in a narrative-mutiple choice format. The nationally available tests of critical thinking were discussed as well as the essay as an effective measure of student thinking. Finally, some considerations to be addressed in selecting or revising assessment procedures were discussed.

To provide some closure on the numerous issues and concerns in transfoming critical thinking form ideal to reality, the next section presents overall recommendations for policy and practice. These recommendations illustrate just how fundamental this transformation has to be if anything beyond incremental changes in individual classrooms is going to happen.

CHAPTER 5: CRITICAL THINKING: RECOMMENDATIONS FOR POLICY AND PRACTICE

A. Directions for Change

> Young people have not been given many opportunities to think in our schools . . . We may prefer to encourage docility, meekness and obedience to authority over intellectual inquiry and rational thought . . . If rewards go to teachers who keep the children quiet and who raise no questions about the curriculum or about experimentation, teachers will soon learn that inquiry, reflection and the consideration of alternatives may be frowned upon . . . the number of pages covered have the highest importance, then thinking experiences may be sacrificed to subject matter importance. Raths, et. al. (1967)

The "critical spirit" involves certain attitudes, dispositions, habits and character traits. It entails a real commitment to the objective evaluation of evidence, a willingness to conform judgment to mindful principles, and a pronounced diposition to seek reasons for what is said or done. If the schools are to foster the critical spirit—principles of rational thought and reasoned judgment—major issues need to be addressed and radical changes need to be made, many of them revolutionary. Changes will be required in our conceptualization of the role of the teacher and in the structure of our educational organizations. The Carnegie Forum calls for schools that provide "a deeper understanding necessary for a self governing society . . . it must enable the citizens of this country to make informed judgments about the complex issues and events that characterize life in advanced economies at the end of the 20th century. The cost of not doing so may well be the gradual erosion of our democratic birthright . . . the focus of schooling must shift from teaching to learning, from the passive acquisition of facts and routines to the active application of ideas to problems. That transformation makes the role of the teacher more important, not less."

B. Towards a Vision of Teachers as Professionals

Wanted

> College graduate with academic major (master's degree preferred). Excellent communication and leadership skills required. Challenging opportunity to serve 150 clients daily, developing up to five different products each day to meet their needs. This diversified job also allows employee to exercise typing, clerical, law enforcement, and social work skills between assignments and after hours. Adaptability helpful, since suppliers cannot always deliver goods and support services on time. Typical work week 47 hours. Special nature of work precludes fringe benefits such as lunch and coffee breaks, but work has many intrinsic rewards. Starting salary $12,769, with a guarantee of $24,000 after only 14 years.

So begins the Rand Report study, "Beyond the Commission Reports: The Coming Crisis in Teaching" by Linda Darling-Hammond (1984), who concludes that today's teachers are increasingly viewed as bureaucratic functionaries rather than practicing professionals. Poor working conditions where teachers are deprived of opportunities for professional growth or stimulation, where teachers are not valued as professionals (and critical thinkers), where teachers spend less and less of their time on instruction are having dire consequences for this profession.

In her report, Darling-Hammond demonstrates that "dramatic changes in our nation's teaching force will soon lead to serious shortages of qualified teachers unless policies that restructure the profession are pursued." She notes that the existing teaching force is decreasing as older teachers retire and younger teachers leave for other occupations, that evidence shows that new recruits to teaching are less qualified academically than those who are leaving, that the most academically able teachers leave the profession within a very short time, and, finally, that the number of new entrants to the profession is insufficient to meet the coming demand. She identifies several factors contributing to this problem: academically talented women and minorities are now choosing careers with greater financial rewards, greater opportunity for advancement, and better working conditions.

In addition to poor salaries, Darling-Hammond observes that teacher dissatisfaction stems from: "lack of input into professional decision making, overly restrictive bureaucratic controls, and inadequate administrative support contributing to dissatisfaction and attrition, particularly among the most highly qualified." Creating more professional working conditions involves a new career structure in which "improved preparation and professional standards of practice are combined with increased responsibility and decision making."

An important concept here is the view of teachers as bureaucratic functionaries rather than practicing professionals. Many teachers would not reenter teaching again, if given the choice, and it is the most qualified who are most dissatisfied. If the best teachers are the most dissatisfied, an examination of the conflict between bureaucratic functionary and professional could shed some light on possible solutions. Teachers have professional expectations to teach, to share their love of their subjects with their students, and find themselves instead working as if on an assembly line production team. But boxed in by bureaucratic mandates to cover ever increasing amounts of content, pressurized by sometimes unrealistic account-

ability measures to raise achievement scores, many teachers who perceive teaching and learning to be more than number crunching, despair. Initiative, inquiry, and creative thinking are not rewarded in most school systems.

Are teachers professionals? And what is a profession? Pierce (1981) notes that a profession may be said to meet the following criteria: a profession (1) depends on a body of knowledge, skills and understandings; (2) provides services to society which utilize that body of knowledge, skills and understandings; (3) provides practitioners with the autonomy to make their own decisions regarding applications of that body of knowledge, skills and understandings; and (4) is responsible for determining and enforcing standards to be met by those who enter and remain in the profession. Pierce says that lay control of education at local, state and federal levels mitigates against teaching becoming a profession and that little or no effort has been made to differentiate between policies affecting education and teaching which should be made by the public, and those which should be made by educators. Goodlad (1975) says that state and local authorities sometimes go so far in educational decision-making that few degrees of freedom in decision-making remain for school administrators and teachers. Further, he says that some of the degrees of freedom remaining frequently are usurped by administrators, leaving little alternative for teachers other than to teach "pre-prepared lessons."

Teachers live in a world where the organization makes their decisions for them. This lack of authority, states Meyers (1973), strikes at the heart of professionalization. Corwin (1965) believes the essential conflict is between two entirely different bases of authority where professionalism equals autonomy and control, and bureaucratization equals conformity and dependence.

Ernest Boyer, President of the Carnegie Foundation for the Advancement of Teaching, describes this as the "unhealthy condition of the teaching profession." He notes that one-third of teachers are dissatisfied with their jobs, and a resounding one-half wouldn't enter teaching again if they had the chance to do it over again. Teacher dissatisfaction stems not only from poor salaries and low status but from the fact that teachers feel stymied because they see no real opportunities for growth or reward in their roles. Darling-Hammond notes that 50 percent of all teachers leave the profession after 5 years and 80 percent leave after 10 years.

The requirements for professionalization do not have to be irreconcilable with the demands of bureaucracies. If the teaching profession is to survive (and thrive), a new vision of the role of the teacher is imperative. A major restructuring of the profession is necessary to expand and enhance this role. Major efforts to renew the profession have to be made to incorporate the necessary respect, support, influence and professional autonomy into this "primary task" of education. One recent study of teacher perceptions of power and powerlessness in their roles (Walsh, 1984) concluded that a say in the decision-making processes of a school differentiates the high power teacher from the low power teacher. Teachers who felt they had professional power reported that their input was sought and utilized by their principals, that they had an influence on school level policy. These teachers felt that they made a difference, not only in their classrooms, but in their schools, particularly in areas that directly affected their teaching function. If critical thinking is to be an educational ideal, then we must value teachers as critical thinkers. Teachers cannot afford to have others (governors, legislators, business people) defining their profession and their practice. As the critical thinking movement in education gears up, teachers themselves have to be a force in defining this issue.

An atmosphere where teachers are valued for their professional skills, for their judgment and their input on important school matters is one which fosters greater professional power and more efffective teaching and learning. Lightfoot (1983) found one common ingredient in good schools was good teachers who were supported by sympathetic leadership and a high regard for teachers and their work. Poor schools, on the other hand, do not treat teachers with respectful regard, while in the worst schools, teachers are demeaned and infantilized by administrators who view them as custodians, guardians or technicians. Lightfoot's recommendation is that schools must collect good teachers and treat them like chosen people. Treating teachers like chosen people starts with treating them as professionals and valuing their judgment. Part of treating them as professionals involves things like peer-defined standards of practice (including defining the direction of the critical thinking movement), autonomous performance within professionally-defined standards, increased responsibility with increased competence, and increased teacher decision-making.

C. Teacher Education-Preservice and Inservice

A reexamination of what we value in education and in teaching is crucial. A major element of this reexamination has to be the preparation of educators and the role of a theory of thinking in teacher education.

Colleges of education have taken a beating in the latest education reform movement. These colleges are being blamed for having few, if any, entry standards, for an overemphasis on "boring" pedagogy to the detriment of subject matter, for non-existent exit requirements, and for inadequate preparation for the real world of the classroom. Lipman et. al. state that "the improvement of the quality of teachers will not take place unless the schools of education can attract young people with richer resources than are currently being attracted into the profession . . . this will not take place unless teacher preparation programs can satisfy the intellectual and creative needs of these young people who presently are repelled by the lack of intellectual challenge in many teacher education programs."

These ideas have tremendous implications for teacher education. As noted, our institutions of higher education simply perpetuate the approaches of elementary and secondary education: memorization and recall. The primary mode of instruction in higher education is didactic (lecturing), with little emphasis on such teaching methods as the Socratic approach for enhancing the meaning of the material and the thinking of the students. The essence of a

teacher-education program should be twofold: to encourage and enhance the critical thinking skills of prospective teachers and to teach them techniques for successfully encouraging critical thinking skills in their future "communities of inquiry." Lipman et.al. note that encouraging teachers to be versatile in inquiry provides them with the kind of intellectual flexibility and resourcefulness that they can apply to any concrete matter—that a prerequisite of a teacher education program is that it should be reflective and that it establish the classroom as a focus of inquiry.

Not only is there an urgent need to incorporate the concept of critical thinking throughout preservice teacher education (incorporating critical thinking throughout all coursework should be mandatory in teacher training programs), there is as great a need for significant inservice education in critical thinking for adminstrators and teachers. This is where true organizational commitment to the critical thinking movement has to be reinforced by support and resources for those who are to pursue this "new" central endeavor of the educational process.

Unfortunately, inservice has a negative connotation to most teachers. Traditional inservice education of teachers has perpetuated the lecture/lack-of-participation mode. Often teachers are not given the professional credibility to know what kinds of professional growth opportunities they need, and the selection of focus and content of inservice training is usually done by school administrators who profess to know better what the teachers need. A recent *Phi Delta Kappan* article on inservicing of teachers compared inservice to the insemination of Flossie the cow.

> My last inservicing went pretty much like Flossie's (insemination). The only difference was that no one had the same clear proof that it took. The teaching staff was herded into a meeting . . . visiting expert appeared . . . proceeded to insert an hour and a half of details into us. And in the end, like poor old Flossie, we didn't get to join in the act and we didn't have much fun. It just happened.
> (Sharma, 1981).

Sharma points out that too often, those in charge of inservice training make decisions for teachers just like the one's her grandfather made for Flossie: they decide when to bring the teachers together, they assume the injection will be useful to all regardless of individual needs, they assume that teachers have too narrow a perspective and that teachers' opinions are not valid.

Most teachers would be able to identify with this analogy. The current environment is not one which fosters inquiry, creativity, initiative or critical thinking in teaching. What is crucial for the success of inservice training in general (and inservice on critical thinking in particular) is a reversal of the current deficit model of inservice, which sees teachers as needing injections of information to improve. What is needed is a developmental model of teacher inservice training which values and respects the teachers' judgment and sees teachers as capable of identifying professional growth opportunities to expand and enhance their skills.

What is the process for involving teachers? How does a school system begin to seek relevant input from teachers? It should be approached thoughtfully and carefully, if we are to be successful in avoiding the temptations of prepackaged, "quick fix" approaches. Long-term planning is necessary, and could include partnerships with universities and school-based critical thinking committees which provide teachers the time to meet together during the course of the school year to develop teaching materials, curriculum, strategies and applications. Falkof and Moss (1984) describe a highly effective critical thinking committee through which teachers meet regularly to develop and enhance their own abilities to foster and encourage critical thinking in their classrooms. Teachers are invested in the district's thinking skills emphasis because they are involved in designing the process and learning from each other. Via their ongoing thinking skills committee, they are able to capitalize on each other's expertise and see how the strategies used at one grade level are necessary in developing more sophisticated thinking skills at upper grade levels. Single inservice sessions will do more harm than good. Integrating critical thinking into the curriculum is a complex process, not something that can be learned overnight. Districts need to send teachers and principals to critical thinking conferences so they can share new information with their coworkers. Teachers need access to books and instructional materials on critical thinking. They will need time to collaborate, consult and observe each other so that they can develop new strategies in the context of their own styles and classrooms. The following standards and recommendations should be integrated into our preservice and inservice education on teaching for thinking:

I. Standards for the Teaching of Thinking

The teacher who effectively "teaches for thinking" will:

- demonstrate an *attitude* of being disposed to consider in a thoughtful, perceptive manner the problems, subjects and issues of her experience; exhibit dispositions of thinking (*intellectual curiosity, open-mindedness, flexibility, objectivity, respect for other viewpoints, persistence, intellectual honesty and skepticism*);
- demonstrate *knowledge* of the methods of logical inquiry;
- demonstrate *skill* in applying these methods in her professional role;
- create a classroom environment where thinking can flouish;
- create a classroom environment which nurtures the dispositions of good thinking;
- demonstrate teaching strategies that integrate both the dispositions and the skills of effective thinking into the curriculum (in classroom *discussion and questioning strategies*, in instructional *strategies, activities and assignments*, and in student *assessment/evaluation tools and techniques*);
- demonstrate the applicability of effective thinking skills and dispositions to other disciplines and areas of the students' lives.

II. Recommendations for Preservice Education

- thinking skills should be thoroughly integrated into all aspects of the teacher preparation program;
- teacher education faculty should model effective thinking strategies in their own instruction;
- subject matter methods courses should explicitly detail the integration of thinking skills within and across disciplines;
- teacher education students should observe effective teaching incorporating a thinking skills emphasis early and often in their educational program;
- the modeling of and use of effective thinking skills strategies should be a priority skill during student teaching, induction periods and other classroom applications;
- beginning teacher tests and induction programs should place a high value on the applicant's reasoning and thinking skills and their application to the classroom.

III. Recommendations for Inservice Education

- any district considering a thinking skill emphasis must make a long-term commitment of time, money and resources to schools which foster student thinking;
- a long-range vision is necessary to incorporate a thinking skills approach into the total school climate;
- induction programs should exist in which new teachers are assisted by mentor teachers skilled in "teaching for thinking";
- inservice training in critical thinking should be designed and based on the needs of teachers;
- teachers should be involved in the development and planning of a long-term inservice program;
- teachers should be given time to meet with colleagues to observe, learn and share effective strategies with each other;
- teachers should have access to thinking skill materials, books, programs, and skill training packages;
- a district-level or building-level committee or task force should guide the development of this emphasis in the school.

Developing critical thinking in the "strong" sense—that fundamental characteristic of the lifelong learner—will take time. This is an evolving process which builds in the child as he or she grows, acquires more knowledge, faces more complex issues and problems. In encouraging and developing this critical spirit, we are not only fostering a character inclined to seek reasons and truth, we also foster what Siegal has described as "the power and the ability to control one's life . . . empower(ing) the student to control his or her own destiny." Such a commitment involves a sustained effort to provide teachers with the necessary supports that nurture the critical spirit of *all* the school's inhabitants.

D. Organizational Considerations

The case for *integrating* critical thinking skills throughout the elementary and secondary curriculum is being made around the country. In addition to a growing recognition of just how unprepared many of our present students are to face the complexities of their world, there is a recognition that traditional views of teaching and learning are inadequate in providing the tools necessary for dealing with the masses of information, propaganda, conflicting ideologies and points of view students will have to effectively deal with if they are truly to have "power and control of their own destinies."

An emphasis on critical thinking requires fundamental organizational change not only in a reconceptualized view of teaching, but in all the fundamental elements of schooling: in organizational commitment to the concept, in the curriculum, in texts and instructional materials, in student (and teacher) assessment, and in the resources necessary to do the job. Perhaps most essential is organizational commitment, for the extent of that commitment will determine the success of any system-wide initiative towards critical thinking as an educational ideal. The level of commitment determines the support of the teachers (and students) in the process, and it determines the allocation of resources for the endeavor. Such resources include:

■ Time

A move toward a learning environment which nurtures the critical spirit requires a long-term commitment. Teachers will need time to learn new techniques to add to their teaching repertoires. Long-term staff development (developed and designed with teacher involvement) is crucial. This involves a commitment of resources for teacher release time, for training, for more planning time for teachers to adequately serve student needs, for teachers to be able to confer regularly with each other. Instant results will *not* occur, but gradual, more meaningful change can occur with sustained effort. While many might argue that emphasizing critical thinking skills will take too much time away from content mastery, the counter-argument is that using critical thinking skills *with* content enables students to understand, analyze, synthesize and evaluate the content in such a way to make it "theirs." This reduces the amount of time spent on rote memorization. Students will also retain the information longer if they have a deeper understanding of it in context rather than memorizing discrete bits of information.

■ Funds

Financial resources will be required for a shift toward integrating critical thinking instruction. The training of teachers and administrators, if it is to be meaningful, has to be long-term. Money for teacher release time, for staff to attend conferences, for instructional materials, for stipends for teachers for duties beyond the regular school

day (critical thinking committees, staff development activities, curriculum development, helping other teachers, etc.) will be needed in addition to any revisions in textbooks, tests or other curricular considerations. Caution should be exercised in adapting slick pre-packaged programs which claim to be the "one way" to teach critical thinking. There is no *one* way, but a number of extremely effective ways that teachers can improve their effectiveness in encouraging critical thinking skills. Teachers need to have a basic and sound understanding of the concept and the principles of critical thinking and, from there, can adapt their current strategies to foster such skills. Resourcefulness, autonomy, creativity and discretion are the fundamental ingredients for turning even the most rigid curriculum into an exciting learning adventure. This requires adequate financial support.

■ Class Size

In order to most effectively teach critical thinking, current class sizes must be smaller. Already overwhelmed teachers teaching in overcrowded classrooms cannot be expected to cope with additional demands on their time. Sizer states that teachers *must* have time to effectively encourage and develop thinking. A teacher has to have the time to learn how each child thinks. This can *only* be done in classes of reasonable numbers of students. The discussing, the coaching, the inquiry each child needs to experience to effectively develop critical habits of thought is possible only with a smaller teacher pupil ratio than is now the norm.

■ Standards

All of the reports calling for education reform address the central problem of declining standards, but Sizer, Goodlad and Boyer have really emphasized the imperative to emphasize critical thinking. Boyer recently called on the public schools to double their efforts to "develop within each student and the ability to communicate effectively, to compute accurately, and to think critically." He notes that because of "inadequacies in the educational establishment," corporations are going "beyond basics . . . and teaching analytical skills and critical thinking." Calls for stricter curriculum requirements need to address the issue of critical thinking in the curriculum, and the overemphasis of standardized achievement scores which primarily focus on memory and rote recall as sole measures of accountability.

■ Tests

Recognizing that 95 percent of our standardized test items test for memory and recall, states such as Connecticut, Michigan and California are reassessing and revising their assessment instruments. As mentioned in the section on assessment of critical thinking skills, it is possible to redesign test instruments to incorporate critical thinking skills even in multiple choice items. While multiple choice tests can be designed to tap minimal and discrete critical thinking skills, the essay test is a better indicator of a student's ability to perform extended analysis. Extreme care must be taken not to perpetuate some of the dilemmas in the existing assessment process. As Berliner (1984) notes, "school districts and states fail schoolteachers by choosing achievement tests that do not match the curricula teachers are teaching. If a district has been using the Addison-Wesley math textbook, for example, and the Stanford Achievement Test as a measure of math achievement, only 47 percent of the test items will be familiar to the students—53 percent of the items will not have been covered in the textbook. This kind of situation forces teachers, who are held accountable for the test scores, to teach to the test for mere survival."

The testing issue for critical thinking assessment will be fraught with the same kinds of problems unless there is great care taken to develop valid and reliable measures of students' critical thinking skills, to assure that the tests correlate with the instructional materials being used, and to provide adequate preparation and training of administrators and teachers. Some states are revising student tests in massive efforts to incorporate critical thinking skills without a comprehensive program of staff development to train teachers in developing critical thinking skills throughout the curriculum. Such approaches are destined for disaster when teachers are, in effect, set up for failure by being held accountable for developing student skills which they have had little or no training in developing.

As mentioned, the AFT supports the use of standardized tests as a measure of educational performance, and the use of fair and objective tests free of cultural and racial bias. These tests should relate to the curriculum. They should relate to overall learning goals. Teachers need to be involved in the development of new tests to integrate critical thinking skills into subject areas, for they bring to the endeavor the strengths of knowledge of content and knowledge of children's cognitive abilities. Teachers should be provided with adequate training in developing and assessing critical thinking skills and in developing teacher-made tests to assess these skills.

■ Texts and Instructional Materials

Studies show that teachers use textbooks and commercial instruction materials for a significant proportion of their instructional time. These materials, consequently, determine the substance of the curriculum. The recent reform movement has highlighted the decline in textbook quality, the "dumbing down" of American textbooks which has occurred at the elemen-

tary, secondary, and university levels. Simple vocabulary, a decline in the quality of writing and poor instructional design are among the problems cited. These problems have grave implications for education in general, and for critical thinking in particular, since these skills have never been comprehensively or systematically incorporated into the activities and questions for students or teachers. As the critical thinking movement gains in momentum, the demand for quality materials to support this movement will increase, resulting in pressure on textbook companies to revise existing materials and develop new ones. Teacher input should be sought for these revisions.

■ Committees/Staff Resources

Ongoing critical thinking committees can provide teachers with professional growth opportunities to develop and enhance their own critical thinking skills and their application to the classroom. Rosenholtz and Smylie (1983) have found that a major impediment to improving teachers' effectiveness is their professional isolation from colleagues. They say that teachers acquire and perfect their teaching skills more readily in settings where there is a mutual sharing of ideas, materials and problems among colleagues and that teachers are motivated to attempt new strategies if they believe they will increase their ability to help students learn. Teachers have to believe their efforts will have a positive effect on student progress and need to have the support of colleagues and administrators in their efforts to improve and enhance their skills.

An ongoing supportive committee can surmount the obstacles of the single inservice session by providing a forum for professional dialogue and for experimenting and risk taking. A group of teachers in a Chicago suburb began research on the issue of critical thinking that eventually led to a district-wide thinking skills program. With financial support from their district, a nucleus of teachers began by investigating two critical thinking skills in summer workshops: making analogies and making inferences. In the fall, summer workshop participants began to share some of their strategies with colleagues. Teachers worked together throughout the year, and in the second summer of planning, they added new staff and new strategies. That year they began a district-wide program using members of the committee to lead inservice training. Their goal was to "make teachers aware of how they were already using many effective techniques and how these and other strategies could improve thinking, and how they fit into particular curricula." The program was successful because the teachers were involved in the process, and therefore they were invested in the program. This is an important conclusion. Too often school administrators are tempted to mandate a potentially good program without meaningful teacher involvement.

Change in an organization is a challenging, often threatening word. The changes in education called for in a real commitment to critical thinking are enormous. They will have profound effects on all aspects of an educational system if they are truly to be meaningful changes. *How* an organization goes about approaching change is crucial. The extent of bureaucracy in many large systems mitigates against changes initiated at the "top" ever being implemented at the "bottom." Without staff involvement, the top management doesn't get the advantage of the from-the-trenches point of view, teacher-perceived strengths and weaknesses, of suggestions for how a plan could be enhanced, modified, or improved to prevent problems from developing. Japanese companies, through the help of American businessman Deming, have capitalized on this concept of involving employees in decision making and getting feedback from them on improving the system. Employees, through a structured participation process, make recommendations to management based on their own expertise in working within "the system."

Peters and Waterman in *In Search of Excellence* (1983) describe the secrets of success in America's best-run companies. At the top of their list of effective management practice is that of treating workers with respect and viewing them as the most important asset of the organization. This involves the encouragement of innovation, autonomy and experimentation, and "rich, informal two-way communication." Whatever the vehicle, new ways of approaching change in schools are necessary.

In their school effectiveness research, Purkey and Smith (1982) concluded that consensus, collaboration, cooperation and collegiality in school decision-making differentiated the effective school from the ineffective. Such decision-making "from below" is simply much more effective than "top down" mandating with professionals. Schools need to be team efforts. Those that achieve the greatest gains in student learning are collaborative places characterized by frequent professional dialogue. This requires a change in the school administration from a traditionally autocratic and militaristic approach toward a more democratic, participatory management system which involves teachers in the decision making process.

Besides committees to develop, expand and enhance professional practice in critical thinking skills, there will be many decisions in the transition process that teachers need to have an active role in discussing, defining and deciding, from textbook selection and curriculm development to school testing policies, to training new teachers (who continue to graduate from teacher education programs without any foundation in critical thinking as an essential element of professional practice). The bottom line is that the profession has to be proactive in this movement, not simply reactive.

E. Critical Thinking: Transforming an Ideal into a Reality

The following list summarizes the essentials for an ef-

fective integration of critical thinking skills into the K-12 curriculum. A movement toward critical thinking as an educational ideal is a comprehensive process involving not just small incremental change, but a concerted effort throughout the entire educational process. Reform in this area calls for bold, decisive and immediate action in the following areas:

Essentials for Effective Integration of Critical Thinking

I. The role of the teacher
- a vision of teacher as professional
- valuing the teacher as critical thinker
- increasing professional autonomy
- increasing professional involvement and decision-making in policy
- revising our conception of accountability
- involvement in development of standards of practice in critical thinking

II. The education of the teacher

A. Preservice
- infusion of critical thinking throughout the curriculum
- instructors who model critical thinking practice
- intensive field experience involving observation of master teachers and supervised practice

B. Inservice
- training designed and based on the needs of teachers
- teachers involved in the development and planning of inservice
- access to coursework in the application of critical thinking in the disciplines
- quality long term staff development which capitalizes on teacher expertise and extends existing skills
- regular time to meet with colleagues to observe and learn from each other's successes and failures
- access to critical thinking materials (books programs, skills training packages)

III. The structure of the organization

A. Commitment
- a commitment to an environment conducive to fostering critical thinking
- a realization of the magnitude of the commitment involved
- high expectations for improving and enhancing the thinking skills of all students
- a long range vision of moving toward critical thinking
- a valuing of the teachers and students as critical thinkers

B. Adequate time for critical thinking instruction
- teacher time for preparation and planning
- teacher time to consult with colleagues
- time to train staff
- adequate time to evaluate effectiveness

C. Adequate funding of critical thinking initiatives
- funds to thoroughly train staff (long term with follow-up)
- funds for teacher release time
- funds for staff to attend conferences
- funds for instructional materials
- funds for after-school committee work

D. Class size considerations
- teacher time to effectively encourage and develop thinking demands small class sizes
- time to learn how each child thinks demands opportunities for teachers to work with small groups and to provide individual assistance (teacher aides could provide this time)

E. Increased and improved standards
- consideration of critical thinking instruction in analysis of existing standards
- an emphasis on critical thinking goals translated into revised standards
- an examination of current effectiveness in developing student thinking

F. Test revision
- an analysis of critical thinking skills in existing testing programs
- a revision, where necessary, of test emphasis to incorporate critical thinking
- provisions for teachers to use essay tests in critical thinking assessment (time, aides)
- involvement of teachers in the development of assessment measures

G. Texts and instructional materials
- teacher involvement in text evaluation and selection
- education of publishers on need to incorporate critical thinking into their materials
- texts coordinated and matched with appropriate tests
- selection committees that choose materials on the basis of thinking demanded of students

H. Critical thinking committees
- appropriate support and funding for ongoing committee work
- adequate time for teachers to meet and consult with each other
- consideration and implementation of committee recommendations

I. Community involvement
- education of relevant groups on the goals and

purposes of enhancing student thinking abilities

- assistance for parents to foster cognitive growth and critical thinking in home-school partnerships
- liaisons with business and community groups to develop opportunities for real life application of critical thinking skills

J. Research considerations

- the development of future research programs and activities to support critical thinking instruction
- funding to further research and research-based training
- partnerships between schools and universities with teachers involved as action researchers

The education reform movement provides a rich opportunity and environment for change. The challenge will be making the right changes. The case for fostering thinking skills in our schools was never stronger. Comprehensive principles of rational thought and reasoned judgment are the survival skills of the future. An individual with the critical spirit, with a commitment to the objective evaluation of evidence, a willingness to conform judgment to mindful principles and a disposition to seek reasons for what is said and done, has the potential for unlimited contributions to the world in which he or she lives. The magnitude of the issues and the problems facing us in our world require such reasoned judgment and rational thought. This is the essence of hope for the future: better answers and solutions for some of the profound challenges of the day. If the schools do not rise to meet this need, what social institution will? And if this is not the fundamental task and ultimate justification for public education, what is?

APPENDICES

Appendix A

Sample Questions in Various Disciplines

The following subject-specific questions have been developed as an example of the kinds of questions that can be formulated which foster thinking critically about course content. Bloom's taxonomy has been used as the model here, but only as an example of a tool useful in providing a framework—or description of—cognitive processes from which varying types of questions can be developed. The taxonomy should not be used as a prescription for teaching and developing lists of questions in each category. As discussed in the text, there are misleading implications in the hierarchy: that there should be an orderly progression from one level to the next, and that one category is superior to the next. Its usefulness is as a framework for enhancing the teacher's questioning repertoire when the various cognitive processes are considered in the context of a lesson or discussion.

Planning for Thinking I: Social Studies - H.S. Topic: The U.S. Constitution

knowledge: (eliciting information, testing recall): Who wrote the U.S. Constitution and why?

comprehension: (translating, interpreting, extrapolating): Summarize the history of events leading up to the writing of the Constitution.

application: (applying information to new situations): If you were to write a constitution for the senior class, how would you go about writing it?

analysis: (breaking down into component parts, forms): Contrast the Constitution with the Pledge of Allegiance. How are these two documents the same? Different?

synthesis: (combining patterns into a new pattern): Since the Constitution was written over two centuries ago, how would you change or improve it knowing what you know in the 1980's?

evaluation: (judging according to some set of criteria): Has the Constitution served this country well? Justify with examples.

Planning for Thinking II: Social Studies - Elementary Topic: The Pledge of Allegiance*

knowledge: Say the Pledge.

comprehension: Tell in your own words what "allegiance" and "indivisible" mean. Paraphrase the Pledge.

application: What does liberty (or justice) on the playground mean? To what groups or people do you owe allegiance? What else is indivisible in the same sense as our nation?

analysis: What parts of the Pledge refer to you? to our nation? Compare the Pledge to another pledge—how are they the same or different?

synthesis: Write a pledge to your family that all members would be willing to sign. Write a class pledge.

evaluation: Should every nation have a pledge? Support your position. Should everyone say the Pledge? Support your position. How could the Pledge be improved? Why?

*(This example is taken from Hunter, Madeline. *Increasing Your Teaching Effectiveness*. Pitman Learning, Inc., Palo Alto, CA: 1981.)

Planning for Thinking III: Art - High School Topic: Pottery

knowledge: What are the necessary ingredients of pottery clay? How much of each ingredient is needed?

comprehension: How does the centrifugal force of the pottery wheel assist the artist? Explain this process.

application: What other types of art does gravity have an effect on? Give examples.

analysis: Describe the types of hand pressure necessary to work with large bulky types of pottery and small fine pieces.

synthesis: Take a piece of clay and mold it into a design that suits your emotions, your mood today.

evaluation: Critique your creation according to how well it meets the criteria of representing your mood today.

Planning for Thinking IV: Art - Elementary Topic: Drawing Your Body

knowledge: If you wanted to make a life-size picture of yourself, how would you do it?

comprehension: Is your cutout exactly like you or is it a mirror reflection of you? Why?

application: If you wanted to make a life-size picture of your dog, how would you go about doing it?

analysis: How would you obtain life-size measurements of your fingers? eyes? hair? Which is easier to measure and draw? Why?

synthesis: Make a life-size picture of a child your age who might live on the moon. What would he/she wear? What kind of moon shoe would you make?

evaluation: Critique one of your self-portraits. Does it look like you? Why or why not? How could it be improved?

Planning for Thinking V: Mathematics - High School Topic: Distance

knowledge: Where do you look on a map to determine the distance from point A to point B?

comprehension: What is the purpose of and the idea behind the use of a legend on a map? How is the scale of miles used?

application: What other types of reference materials would a legend be useful for? Give examples.

analysis: Outline the steps you would follow to determine the distance between New York City and New Orleans.

synthesis: Using the map to determine the distance between New York and New Orleans in miles and then determine how to compute the mileage into metric measurement.

evaluation: How useful would a scale of miles be to you if you were to take a long distance trip. Under what situations would you judge the scale to be most useful?

Planning for Thinking VI: Mathematics - Elementary Topic: Subtraction

knowledge: Recite the subtraction facts, numbers one through ten.

comprehension: Please describe to the class how to find out how many more boys than girls are in our classroom.

application: If you were in a store and the cashier told you the total was more money than you had with you, what would you do?

analysis: Explain the difference between subtracting, adding, dividing, and multiplying and give an example of when you would need to use each.

synthesis: Using the Candyland game as a base, create a new game using only subtraction skills in it.

evaluation: Which is the best way to quickly subtract: memory, fingers, calculator, abacus? And why?

Planning for Thinking VII: Science - High School Topic: The Digestive System

knowledge: Draw a picture of the body's digestive tract and label all parts.

comprehension: Describe the process of digesting an apple. What happens from the time you eat the fruit until the body completes the process?

application: Explain what would happen if a child accidentally swallowed a penny. How would the digestive system respond?

analysis: On your diagram labeling the digestive system, explain what are the functions of each of the parts labeled.

synthesis: Combine the functions of the digestive system and the neurological system and explain how these two systems work to complement each other.

evaluation: If the digestive system were a machine, how would you rate its efficiency?

Planning for Thinking VIII: Science - Elementary Topic: Growing Plants

knowledge: Here is a diagram of the potato plant. Identify the parts of the plant by placing its name next to the part.

comprehension: Can you describe the process of your plant's growth from the potato in the jar of water to the leafy plant you have now.

application: You have been nurturing your plant with care and water and sunlight. What kind of nurturing do humans need?

analysis: Describe what happens in the roots of the plant, in the growth of the leaves, in the photosynthesis process: What are the effects of sunlight, water, care on your plant?

synthesis: Develop a step-by-step plan for plant caretaking that a new student might use, based on your experience.

evaluation: As a result of your experience growing this potato plant, would you say that tender loving care makes a difference in the plant's growth? Justify your response.

Planning for Thinking IX: Language Arts - High School Topic: The Scarlet Letter

knowledge: State the main characters and the location of the story.

comprehension: Summarize in three paragraphs the events in the Scarlet Letter.

application: If this situation of Hester Prynne were to happen today, what would happen to her?

analysis: How was this scandal viewed by the society of the time? by Hester herself? by the father of the child? by the child?

synthesis: If it were necessary to censure someone today for inappropriate behavior, describe what kinds of consequences would occur.

evaluation: In your opinion, was the ostracism of Hester Prynne appropriate and justifiable by the society of the time period? Why of why not?

Planning for Thinking X: Language Arts - Elementary Topic: Tom Sawyer

knowledge: List the names of all Tom's friends and relatives.

comprehension: What happened when Tom ran away from home?

application: If you ran away from home, how would your experience be similar or different from Tom's.

analysis: Compare Tom's view of his run-away to his aunt's view. Why did each feel this way?

synthesis: Write a new ending to this story describing what might have happened to Tom if he never came back home.

evaluation: Who is the wisest character of this story. Justify your choice.

Planning for Thinking XI: Music - Elementary Topic: Folk Songs

knowledge: Give an example of a contemporary folk song.

comprehension: What does the expression "folk song" mean? Why are some songs called "folk songs" and some are not?

application: If you were going to write a folk song about something in your life, what would it be?

analysis: Here are 20 contemporary songs. List them by category (folk, rock, jazz, blues, etc.)

synthesis: Using the (tune) music from Puff the Magic Dragon, write a folk song about something important in your life.

evaluation: Going by our definition of what a folk song is, assess whether your new song qualifies.

Planning for Thinking XII:
Music - High School
Topic: The School Spring Musical

knowledge: Make a list of main characters of our play and the type of person (characteristics, personality, etc.) we need for each part.

comprehension: Summarize the play for the school program (no more than a one-page summary).

application: What would happen if any of our leading characters were to be sick on opening night. How would you plan for that event?

analysis: Develop a list of procedures needed for lighting, for sound, for staging, for costuming.

synthesis: Develop a checklist of every possible consideration for the play to be used for dress rehearsal.

evaluation: Determine whether your play planning has been sufficient on the basis of smoothness at dress rehearsal. What needs to be added/changed for opening night?

Planning for Thinking XIII:
Physical Education - Elementary
Topic: Doing Somersaults

knowledge: What is the best type of clothing for doing somersaults?

comprehension: Explain the necessary steps for completing a safe somersault.

application: Show us how to do a somersault in the safest manner possible.

analysis: Teach a younger child how to do a somersault by demonstrating and verbally describing the steps at the same time.

synthesis: Develop a routine to music using the somersault in combination with any other activity of your choice.

evaluation: Watch your team perform individual somersaults and rate each one on the basis of form and safety, on a scale from one to ten.

Planning for Thinking XIV:
Physical Education - High School
Topic: Swimming Safety

knowledge: Before entering the water, identify the pool safety rules to your team.

comprehension: Explain why each of the pool rules are necessary.

application: What kind of authority does a lifeguard have? What other types of authority in society do we have to obey as if our life depended on it?

analysis: Describe the steps you would take if you were to see a swimmer in trouble.

synthesis: How could you improve on the rules as they are now written?

evaluation: Do you feel the rules are effective? fair? comprehensible? Support your position.

Planning for Thinking XV:
Vocational Education - Elementary
Topic: Careers - Helping Professionals

knowledge: Give examples of helping professionals in our society.

comprehension: Why do we call professionals such as doctors and teachers "helping professionals?"

application: Here is a list of various jobs in our community. Decide whether these jobs are helping professions. Why did you choose these?

synthesis: Write a job description of an ideal teacher.

evaluation: Of the helping professionals you know personally, identify those that you think best fit the qualities that you have identified and explain why.

Planning for Thinking XVI:
Vocational Education - High School
Topic: The Job Interview

knowledge: List the steps necessary in preparing for the job interview; list the criteria for an effective job interview.

comprehension: Why is it important to study the company and the nature of the position you are applying for before the job interview?

application: If you were the interviewer for this position, what questions would you ask you in the interview?

analysis: Describe the considerations you need to take into account: (1) before the interview, (2) at the beginning of the interview, (3) at the end of the interview, and (4) following up the interview.

synthesis: Create an interview scenario answering the questions you have developed (see "*application*") as the interviewer in your ideal of an effective interview.

evaluation: Have a classmate role play the job interview with you, each taking the role of the interviewer and interviewee. Evaluate your performance based on the criteria of an effective interview.

Appendix B

Definitions of Critical Thinking Terms

Analysis	Separation of a thing into the parts or elements which it is composed
Argument	Discourse intended to persuade; reasons offered in proof
Assumption	Something presupposed or taken for granted
Categorize	To put into a division used to classify
Compare	To examine for likenesses and differences
Concept	A thought, notion or idea
Conceptualize	The power to form ideas or concepts
Conclusion	A judgment or decision reached after deliberation
Consistency	Agreement or harmony in parts or of different things
Contradiction	Inconsistency or discrepancy
Criteria	A standard or test of the value of something
Criticize	To judge or review critically; careful and exact evaluation and judgment
Define	To clarify or outline the character or meaning of something
Deduction	The deriving of a conclusion by reasoning

Egocentric	Thinking or acting with the view that one's self is the center, object and norm of all experience
Evaluate	To appraise, to judge according to some criteria
Evidence	The data on which judgment or conclusions might be based; proof or probability
Explain	To make clear; to give the reason or cause of
Fallacious	Reasoning based on a falsehood; deceptive, misleading, unsound
Generalize	To reach a general conclusion on the basis of particular instances; establishing connections and relationships among otherwise unrelated pieces of information
Hypothesize	To make an assumption, to test its logical or empirical consequences, to predict in order to provide a basis for fuller investigation
Implication	Involve or indicate by inference, association or necessary consequence rather than direct statement; to hint at or express indirectly
Illogical	Contradicting or disregarding the principles of logic; senseless
Inconsistency	Lack of uniformity, congruence of reasoning; erratic; illogical
Induction	Reasoning from a part of a whole or from particular instances to a general conclusion
Inference	To derive as a conclusion from facts, observations or premises; derived from reasoning
Interpretation	To explain the meaning of; to understand according to individual belief, judgment or interest
Irrational	Contrary to reason; illogical
Logical	Ability to reason clearly, in accordance with the nature of logic; consistent
Observing	The gathering of information by noting through careful attention to facts or occurences
Organizing	To arrange or form into a complete or functioning whole, to set up a structure
Prediction	To anticipate beforehand; to determine in advance; applying generalizations from one situation to another
Prejudice	An adverse judgement or opinion formed before sufficient knowledge or examination of facts
Premise	A statement of fact made or implied as the basis of an argument
Rational	Having or exercising the ability to reason; logical
Reasoning	Drawing conclusions or inferences from observations, facts or hypotheses
Relevant	Bearing upon the matter at hand; having reference to the case under consideration
Synthesize	To combine the parts or elements into a whole
Theorize	To form a theory (a principle offered to explain observed facts)
Uncritical	Thoughtless; accepting without reservation

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American Federation of Teachers, AFL-CIO
555 New Jersey Ave., N.W.
Washington, D.C. 20001